



schools online curriculum content initiative

LEARNING OBJECTS **Catalogue**



APRIL 2007

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Mathematics and numeracy learning objects

The Mathematics and numeracy online curriculum content produced by The Le@rning Federation is designed to produce high-quality interactive multimedia learning objects that support and enhance understanding of key mathematical concepts in the P–9 years. The learning objects are based on current research findings in mathematics education and pedagogy. They focus on mathematics concepts that are often the most difficult for students to learn and for teachers to teach and encourage higher-order thinking and problem-solving approaches.

The learning objects make use of the digital environment in innovative ways to enhance student learning. For example, some objects allow teachers to set up learning opportunities in mathematics that are normally too complex in a standard classroom; others allow students to visualise and apply mathematics concepts in new ways; others provide opportunities for repeated use by students through randomisation of learning activities; relevant and authentic contexts for exploration and skill application are a feature of others. Scaffolding of student learning and feedback in various multimodal formats are incorporated into all the learning objects.

The learning objects are published in series and some learning objects within a series are aggregated into single learning objects. Aggregated learning objects are identified with the symbol .

In this catalogue, the series of learning objects are grouped into the commonly used strands of Mathematics. Descriptions of learning objects released to date are provided with a key graphic image. An asterisk (*) indicates that a learning object is in development.

Some learning objects contain non-TLF content. See the Acknowledgements and Conditions of use in the learning objects for details.

An online Guide for teachers for using the Mathematics learning objects produced in 2004 is available on the TLF website in the Mathematics and numeracy curriculum area, which is found under *About TLF content*.

In addition to TLF produced learning objects, TLF also makes available digital content from other sources. This is also listed in this catalogue.

Content from other sources

The Le@rning Federation licences digital content for years P–12 from other sources to include in the pool of online curriculum content available to Australian and New Zealand schools. Mathematics and numeracy content licensed from the National Library of Virtual Manipulatives, USA and from Alberta Education, Canada is now available.

Access

Government and non-government education authorities in each Australian state and territory and in New Zealand have responsibility for facilitating access to the pool of learning objects. Contact TLF's Contact Liaison Officer (CLO) in your state, territory, school sector or country for details.

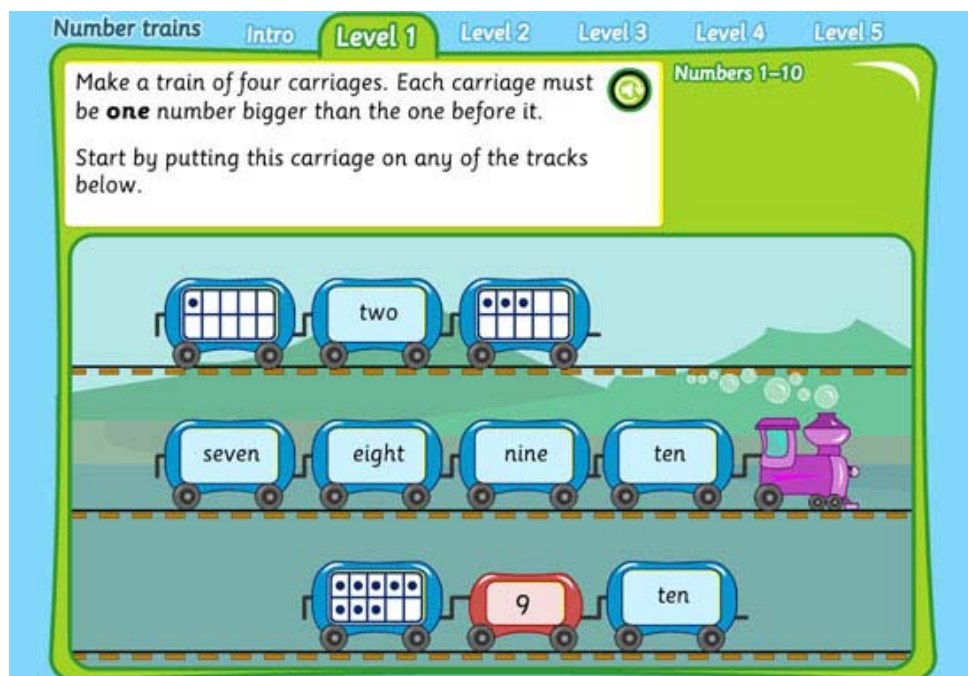
For further information about TLF, learning objects and contact details for CLOs, visit the website at www.thelearningfederation.edu.au.

Number: exploring number

The Number: exploring number learning objects released to date have are grouped into the following series.

Number trains (Years P–3)

The Number trains series is designed for students to practise whole number sequences using numerals, quantities (eg dots) and words. Thinking is focused on considering the number that comes before and after given numbers.



Learning objects	LO ID	Years
Number trains: numbers 1 to 10	2318	P–1
Number trains: numbers 1 to 20	2319	P–1
Number trains: numbers 30 to 50	2320	1–2
Number trains: numbers 90 to 120	2321	1–2
Number trains: skip counting	2322	1–3
Number trains 🎲🎲🎲	2317	P–3

Number trains: numbers 1 to 10

Students place train carriages on a track in order, one at a time, by working out the number that comes before and after the number on each carriage of whole numbers to 10.

Numbers are represented as words, numerals and dots, which represent quantities.

Number trains: numbers 1 to 20

Students place train carriages on a track in order, one at a time, by working out the number that comes before and after the number on each carriage of whole numbers to 20.

Numbers are represented as words, numerals and dots, which represent quantities and numbers represented on dice.

Number trains: numbers 30 to 50

Students place train carriages on a track in order, one at a time, by working out the number that comes before and after the number on each carriage using whole numbers from 30 to 50.

Numbers are represented as words and numerals and MAB Blocks.

Number trains: numbers 90 to 120

Students place train carriages on a track in order, one at a time, by working out the number that comes before and after the number on each carriage using whole numbers from 90 to 120.

Numbers are represented as numerals only.

Number trains: skip counting

Students place train carriages on a track in order, one at a time, by working out the number that comes before and after the number on each carriage. Students use skip counting by twos, fives and tens.

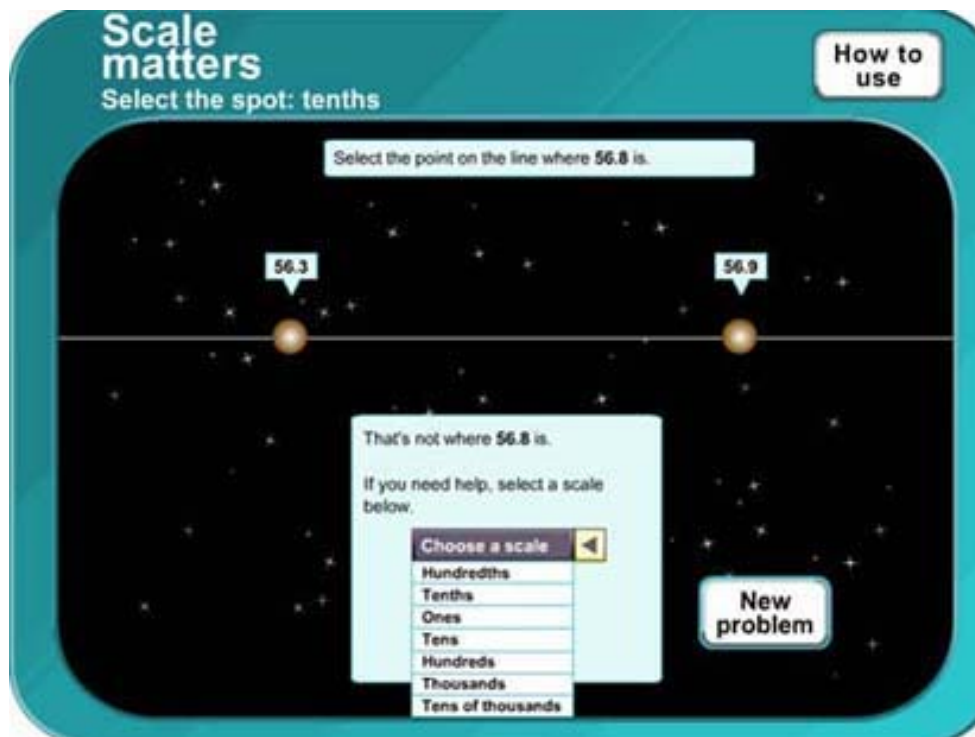
Numbers are represented as numerals only.



Number trains

This is an aggregated learning object combining the five other learning objects in a sequence.

Scale matters (Years P–8)

The Scale matters series is designed to provide students with a variety of experiences in the use of scale on a number line.



Learning objects	LO ID	Years
Scale matters: ones	2003	P–2
Scale matters: tens	2004	2–4
Scale matters: hundreds	2005	2–4
Scale matters: simple units 	2002	P–4
Scale matters: tenths	1998	4–6
Scale matters: tens of thousands	1999	4–6
Scale matters: hundredths	2000	6–8
Scale matters: negatives	2001	6–8
Scale matters: range of numbers 	1997	8–9

Students select a scale to ‘investigate’ (ones, tens, hundreds, tenths, hundredths, tens of thousands or negatives) and then one of two activities. The ‘Name the number’ activity asks students to give the number for a highlighted point on the line. The ‘Select the spot’ activity requires students to place a given number on the number line. In solving both of these problem types the students are prompted to choose a scale to create appropriate scales on the number line. The learning objects provide feedback to the student about accuracy of placement or identification of the number.

The learning objects assist student understanding of scales as diagrammatic representations reflecting the placement of unit lengths along a line; scales are additive and multiplicative, in that parts of scales can be separated and combined and scales can be discrete (whole numbers) or continuous (eg decimals, fractions).

Scale matters: ones

This learning object makes use of a scale of ones.

Scale matters: tens

This learning object makes use of a scale of tens.

Scale matters: hundreds

This learning object makes use of a scale of hundreds.

Scale matters: simple units

This is an aggregated learning object combining Scale matters: ones, tens and hundreds.

Scale matters: tenths

This learning object makes use of a tenths scale.

Scale matters: tens of thousands

This learning object makes use of a tens of thousands scale.

Scale matters: hundredths

This learning object makes use of a hundredths scale.

Scale matters: negatives

This learning object makes use of a negative numbers scale.

Scale matters: range of numbers

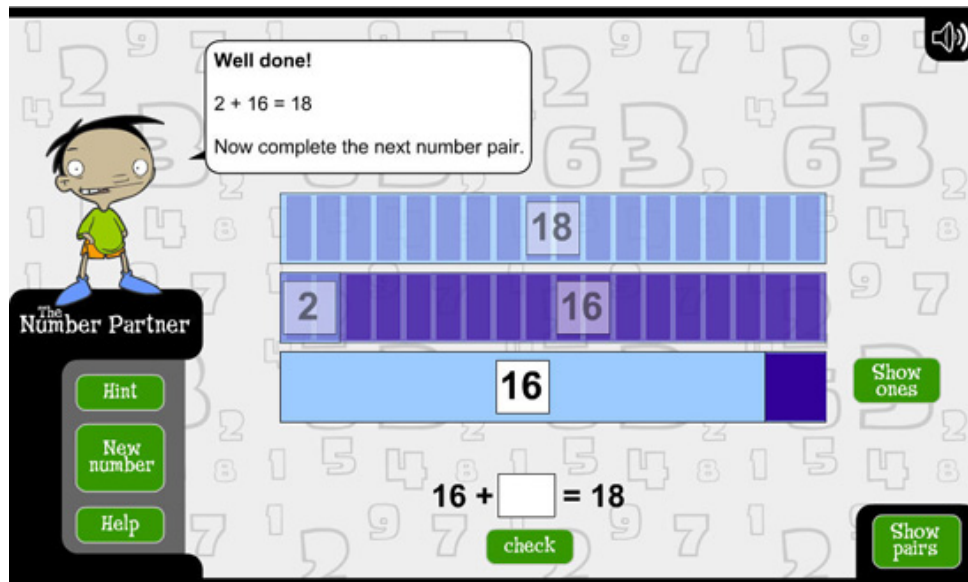
This is an aggregated learning object combining Scale matters: tenths, hundreds of thousandths, negatives and hundredths.

Number: addition, subtraction, division and multiplication

The Number: addition, subtraction, division and multiplication learning objects released to date have are grouped into the following series.

The number partner (Years 2–4)

The number partner series is focused on students developing efficient mental arithmetic strategies. Students explore part-whole relationships of numbers and use these to investigate strategies such as 'make to 10', 'doubling' and 'counting on from the larger number'.



Learning objects	LO ID	Years
The number partner	103	2–4
The number partner: go figure	105	2–4

The commutative property of addition is explored. Students are presented with a bar model to assist with addition. They are able to partition or extend numbers to use known addition facts to assist their mental computation. Addition exercises are presented to students or they can choose to create their own.

Accompanying these investigative learning objects is a tutorial that is designed for use by the student or as a demonstration tool for the teacher.

The part-adder (Years 3–6)

The part-adder series is designed to help students understand how to break up numbers so they can calculate addition mentally. Students use a linear model and part-whole relationships to find their answer.

Press Enter or Return when you are happy with your answer.

$27 + 31$

The Part-Adder

Hint

New sum

Help

20 7 20 11

$27 + 31 = 20 + 7 + 20 + 11$

= 51

Enter your final answer here.

Reset

Learning objects	LO ID	Years
The part-adder: make your own easy sums	91	3–6
The part-adder: make your own hard sums	92	3–6
The part-adder: generate easy sums	93	3–6
The part-adder: generate hard sums	94	3–6
The part-adder: go figure	96	3–6
The part-adder 🎨	220	3–6

Strategies include: 'tens and ones' where students add the 'tens' and the 'ones'; 'doubling' where students focus on their knowledge of the two times multiplication table; 'make a ten' where students break up one or both numbers so they are adding to a multiple of ten; and 'compensate' where students can make one number larger and subtract the number they have added on.

The learning objects provide groups of additions graded in difficulty. There is also an opportunity for students to construct their own calculations.

There is an animation at the commencement of the learning object that demonstrates some of the strategies, and hints are also available. The 'go figure' learning object is amenable to a screen reader, which could also be used as a tutorial with groups of students.

'The part adder' is an aggregated learning object combining the five other learning objects.

The difference bar (Years 3–6)

The difference bar series of learning objects focuses on students learning mental strategies to calculate the difference between two numbers.

Learning objects	LO ID	Years
The difference bar: make your own easy subtractions	109	3–6
The difference bar: make your own hard subtractions	110	3–6
The difference bar: generate easy subtractions	111	3–6
The difference bar: generate hard subtractions	112	3–6
The difference bar: go figure	114	3–6
Difference bars 🧩	224	3–6

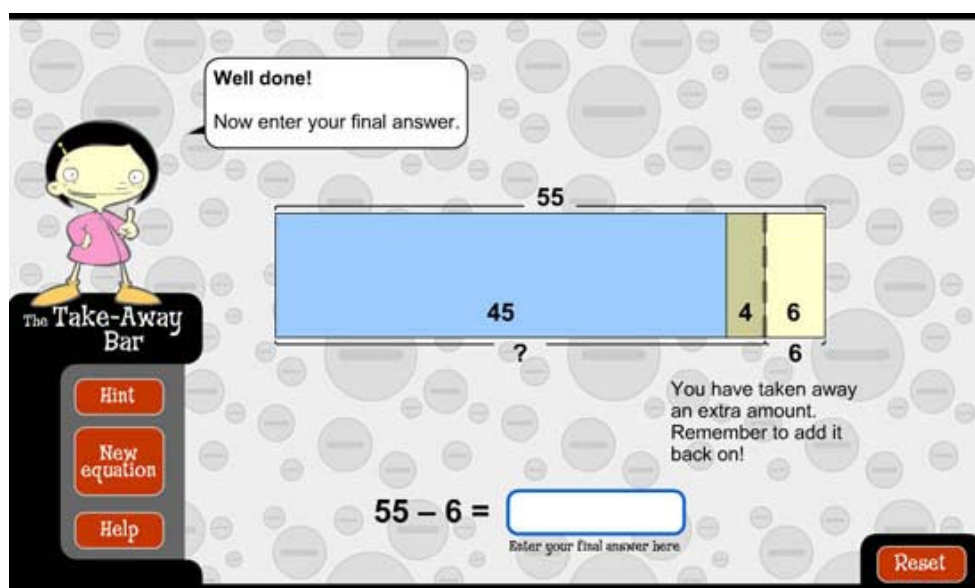
The basic strategy employed is that the difference can be found by addition. A linear model is used to help students see the value of strategies such as rounding to 10, or compensating to the next 10 to help find the difference. Differences are presented to students or they can choose to make up their own.

'The Difference bar: go figure' learning object is suitable for a screen reader, and can be used as a tutorial for a whole class or for small groups of students.

'Difference bars' is an aggregated learning object combining the five other learning units.

The take-away bar (Years 3–6)

The take-away bar series is designed to explore effective mental strategies for performing subtractions.



Learning objects	LO ID	Years
The take-away bar: make your own easy subtractions	97	3–6
The take-away bar: make your own hard subtractions	98	3–6
The take-away bar: generate easy subtractions	99	3–6
The take-away bar: generate hard subtractions	100	3–6
The take-away bar: go figure	102	3–6
Take-away bars 🎨	221	3–6

A linear model is employed so students can see the effect of breaking up numbers to allow the subtraction to be performed using known facts.

A hint section demonstrates two strategies using the linear model. One strategy is to 'round to the nearest 10', in which the idea is to break up one number so that the first part of the subtraction results in a multiple of 10. This strategy is most applicable with subtractions like 42–6. Split the 6 into 2+4; first take the 2 from 42 to make 40, and then take the 4 from 40, resulting in the answer of 36.

The 'compensate' strategy is also explored; for instance, in a subtraction like 42–8; 'compensate' the 8 to make 10, so the calculation becomes 42–10+2, and the calculation process is 42–10 equals 32, 32+2 is 34.

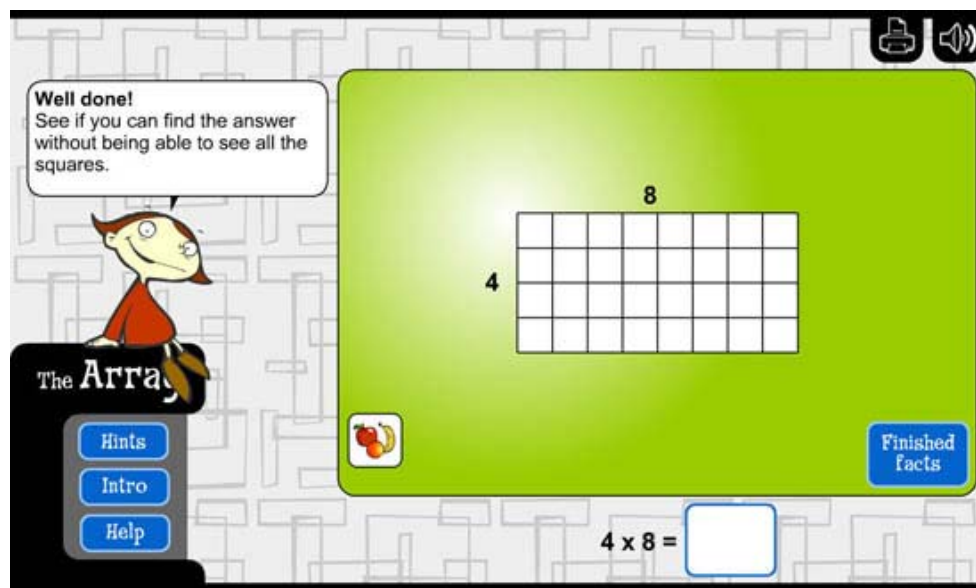
These strategies are also available through an animation that appears on launch of the learning objects. The learning objects provide the opportunity for students to engage with 'easy' or 'hard' pre-programmed calculations or to enter their own.

The tutorial learning object of 'the take-away bars' is amenable to a screen reader, and can be used as a whole-class or small-group tutorial for students. The strategies of 'round to the nearest 10', 'compensate' and place value are demonstrated.

'Take away bars' is an aggregated learning object combining the five other learning objects.

The array (Years 2–4)

'The array' is a tool that allows students to create arrays to learn their basic multiplication facts.



Learning objects	LO ID	Years
The array	106	2–4
The array: go figure	108	2–4

Students are encouraged to develop mental strategies for multiplication by 'imagining' the use of 'the array'. The notion of commutativity is explored. For example, students would realise that $3 \times 4 = 4 \times 3$. This learning object is bundled with a tutorial on how to use the array.

'The array: go figure' is an alternative learning object to 'The array'. It describes the different strategies that can be employed for solving multiplication calculations. It includes a number of multiplications for the student.

The primary purpose of 'The array: go figure' learning object is to allow visually impaired students access to the concepts. Although this learning object does not contain audio, the content will be available to a screen reader.

Pobble arrays (Years 2–4)

The Pobble arrays series supports learners in making the shift from additive to multiplicative thinking. The use of the array model of equal rows and equal columns allows the exploration of factors and multiples, and the associated number properties that underlie effective multiplicative strategies.

Pobble arrays: make multiples

28 pobbles need to go through the
4 gates in equal rows and columns.





That's right!

The 28 pobbles are correctly
lined up in 4 columns and 7
rows.

Select Walk to send them on
their way.

Walk

Learning objects	LO ID	Years
Pobble arrays: make multiples	2056	3–4
Pobble arrays: find a factor	2057	2
Pobble arrays: find two factors	2058	2–3

The Pobble array series introduces students to the commutative property of multiplication. A dynamic array provides a visual model to support understanding of the multiplicative relationship between factors. Pobble characters create the rows and columns for the students. In each learning object students make a prediction, test their prediction and then make adjustments if necessary based on feedback.

Pobble arrays: make multiples

Students help pobbles to line up and walk through gates by making equal rows and equal columns. For example, assemble 17 pobbles to line up equally behind five gates. Students predict whether the number can be made into equal rows. If not, students add or subtract pobbles to make a number that will work. Students check their predication by watching the Pobbles and seeing if they line up correctly and April through the gates.

Pobble arrays: find a factor

Students help pobbles to line up and walk through gates by making equal rows and equal columns. For example, 15 pobbles need to go through 5 gates in equal rows and equal columns. Students predict how many rows are required. They then check their predication by watching the Pobbles and seeing if they line up correctly and April through the gates.

Pobble arrays: find two factors

Students help pobbles to line up and walk through gates by making equal rows and equal columns. For example, 36 pobbles need to go through the gates in equal rows and equal columns. They then predict how many rows and columns are required. Students check their predication by watching the Pobbles and seeing if they line up correctly and April through the gates.

Arrays* (Years 4–5)

The Arrays series supports learners in making the shift from additive to multiplicative thinking. The use of the array model of equal rows and equal columns allows the exploration of factors and multiples and the associated number properties that underlie effective multiplicative strategies.

Arrays: word problems with products from 35 to 64

When **62** is divided by a number, the answer is **7** remainder **6**.
What is the number?

Let's make an array from your number sentence.
An array with **8** rows and **7** columns with a remainder of **6** equals **62**.

Well done!
When **62** is divided by **8** the answer is **7** remainder **6**.
Next word problem

7 columns
8 rows
56
6 remaining
56 + 6 = 62

Multiply
Number sentence:
columns rows
7 x 8 + 6 = 62

History
47 ÷ 7 = 6 r 5
(6 x 7) + 5 = 47
62 ÷ 8 = 7 r 6
(7 x 8) + 6 = 62

Learning objects	LO ID	Years
Arrays: factor families	2059	3–4
Arrays: word problems with products from 10 to 30	2054	4–5
Arrays: word problems with products from 30 to 50	2055	4–5
Arrays: word problems with products from 35 to 64	2053	4–5
*Arrays: the tool	2061	4–5
Arrays: explore factors	2060	4–5

*Learning object in development.

The Arrays: word problems learning objects are designed to support the development of multiplicative thinking through exploring the relationships between word problems, equations and arrays; between multiplication and division; and between factors, multiples and 'remainders'.

Arrays: solving word problems from 10 to 30

Students are provided with a word problem that requires the application of knowledge of multiplication facts ranging between $3 \times 4 = 12$ to $6 \times 5 = 30$ and includes remainders up to 3, eg 'When 22 is divided by a number the answer is 3 remainder 6. What is the number?' Students are supported in creating a multiplication or division problem number sentence and asked to 'test' and answer. An array is used as a visual model for the number sentence to show if the correct number has been found.

Arrays: solving word problems from 30 to 50

Students are provided with a word problem that requires the application of knowledge of multiplication facts ranging between $6 \times 5 = 30$ to $7 \times 7 = 49$ and includes remainders up to

3, eg 'When 47 is divided by a number the answer is 9 remainder 2. What is the number?' Students are supported in creating a multiplication or division problem number sentence and asked to 'test' and answer. An array is used as a visual model for the number sentence to show if the correct number has been found.

Arrays: solving word problems from 34 to 65

Students are provided with a word problem that requires the application of knowledge of multiplication facts ranging between $5 \times 7 = 35$ to $8 \times 8 = 64$ and includes remainders up to 7, eg 'When 55 is divided by a number the answer is 7 remainder 6. What is the number?' Students are supported in creating a multiplication or division problem number sentence and asked to 'test' and answer. An array is used as a visual model for the number sentence to show if the correct number has been found.

Arrays: factor families

Students make equal rows and columns to explore how numbers can be broken up into factors. For example, the number 24 can be expressed as 12×2 or 2×12 , and it can be divided equally using its factors 12 and 2. Students identify a missing factor to complete a factor family. Students solve four expressions: two multiplication and two division statements for each activity.

Arrays: the tool

This learning object is a task free array-making tool, which is dynamically linked to listing of factors as either multiplication or division number sentences. The open-end nature of the learning object allows the students to carry out their investigations of factors and multiples.

Arrays: explore factors

Students explore how numbers can be broken up with factors. For example, the number 9 can be expressed as 9×1 or 3×3 . Students select a set of numbers between 1 and 50 and then identify the factors of a number in the set by choosing a statement that describes how many factors the number has. This learning object is one in a series of six objects.

The multiplier (Years 3–6)

The multiplier series focuses on developing strategies for multiplication. Students are invited to partition the numbers so they can use known facts to help them calculate 'in their head'.

Well done!
You are now ready to enter your final answer.

12

38

12 x 30 = 360

12 x 8 = 96

12 x 38 = 360 + 96

=

Enter your final answer here

Reset

Hint
x-tables
New equation
Help

Learning objects	LO ID	Years
The multiplier: make your own easy multiplications	61	3–6
The multiplier: make your own hard multiplications	82	3–6
The multiplier: generate easy multiplications	83	3–6
The multiplier: generate hard multiplications	84	3–6
The multiplier: go figure	90	3–6
The multiplier 🧩	219	3–6

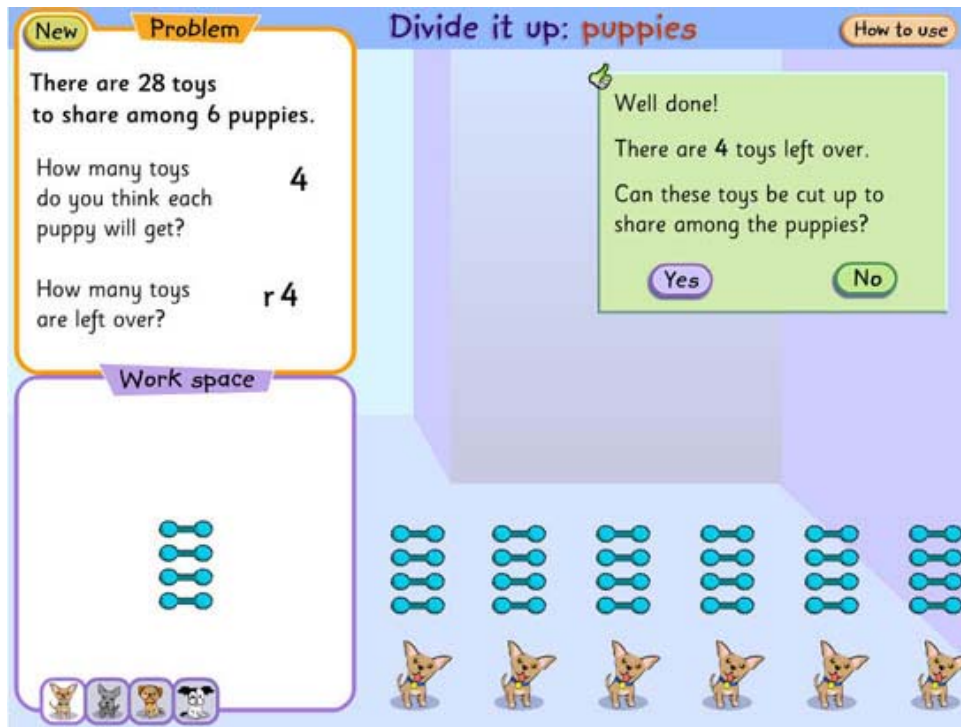
Strategies such as 'making to 10' and 'doubling' are highlighted. The simplest level involves two-digit by one-digit multiplication, and the levels move up to quite complex calculations involving two-digit by two-digit calculations. Learners can choose to complete generated multiplications or to create calculations of their own. Feedback and scaffolding is provided at every step by an engaging animated character.

In addition, there is a comprehensive tutorial that could be used by students individually or in small groups, or as a demonstration tool by the teacher. This tutorial is amendable to screen readers, making it accessible to visually impaired students.

'The multiplier' is an aggregated learning object combining the five other learning objects.

Divide it up (Years 2–4)

The Divide it up series provides opportunities for students to think multiplicatively to solve problems. The learning objects involve sharing division and grouping (repeated subtraction) division in different contexts.



Learning objects	LO ID	Years
Divide it up: kittens	2812	2–3
Divide it up: hardware	2811	2–3
Divide it up: puppies	2808	2–4
Divide it up: grouping tool	2810	2–4
Divide it up: sharing tool	2809	2–4

The Divide it up series uses a range of engaging contexts and context-free tools to allow students to explore division.

Divide it up: kittens

Students interpret a division word problem and its solution. The student is supported by a tool to model the sharing division process and scaffolding to deal with remainders of 1.

Divide it up: hardware

Students interpret a division word problem and its solution. The student is supported by a tool to model the grouping division process and scaffolding to make sense of remainders of 1.

Divide it up: puppies

Students use a dividing tool to help solve division problems in the pet shop. The puppies always want an equal number of toys or biscuits. Students predict how many they will get, or how many packets can be filled. They then check their prediction and decide what to do with any leftover.

Divide it up: grouping tool

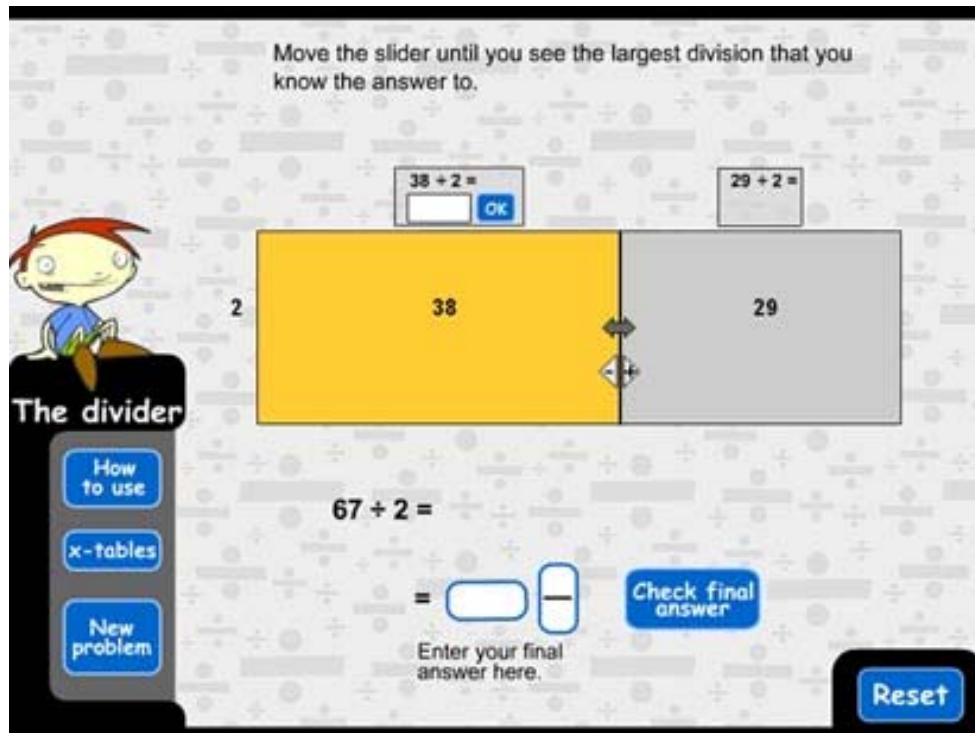
This is an open-ended interactive tool for modelling grouping division with whole number remainders only.

Divide it up: sharing tool

This is an open-ended interactive tool for modelling sharing division with whole number remainders only.

The divider (Years 4–8)

The divider series helps students to use multiplicative partitioning strategies to solve division problems.



Learning objects	LO ID	Years
The divider: without remainders	2007	4–6
The divider: whole number remainders	2008	4–6
The divider: solve your own problem	2009	4–8
The divider: with or without remainders	2006	6–8

Students use a 'slider' partitioning tool to recognise factors and multiples. There is also a times-tables tool available at all times to assist students who struggle with basic multiplication facts. Once the student has solved the last division they are prompted to sum the quotients and provide a final answer, which may or may not contain remainders.

The divider: without remainders

'The divider: without remainders' learning object contains divisional equations that have answers without remainders.

The divider: whole number remainders

'The divider: whole number remainders' learning object contains divisional equations that have answers with whole number remainders.

The divider: solve your own problem

'The divider: solve your own problem' learning object allows the student to input their own divisional problem to solve. The answer may or may not contain remainders.

The divider: with or without remainders

'The divider: with or without remainders' learning object contains divisional equations that have answers with or without remainders.

School canteen (Years 5–9)

In the School canteen series, the student has the responsibility of purchasing stock online for the school canteen. The focus is on the mathematical skills and calculations associated with shopping, including purchase of goods in multiples of fixed units and determining best buys to minimise total costs.



Learning objects	LO ID	Years
School canteen: restock: level 1	1927	5–9
School canteen: restock : level 2	1931	7–9
School canteen: best buy: level 1	1928	5–9
School canteen: best buy: level 2	1932	7–9
School canteen: two traders: level 1	1929	5–9
School canteen: two traders: level 2	1933	7–9
School canteen: estimate and check: level 1	1930	5–9
School canteen: estimate and check: level 2	1934	7–9

Throughout the learning objects in this series, the student is assisted to develop – and encouraged to use – efficient calculation techniques, such as unit price and ratio, to identify best buys and alternative ways to complete the requirements of the canteen order. At the simplest level, this series involves purchase of multiples of units of items from one supplier. At the most difficult level, use of ratio, factors and multiples are required to be applied to the catalogues of more than one supplier to meet the challenges of completing the order at the lowest possible cost to the school.

School canteen: restock: level 1

Students choose how to order school canteen items available in a range of packaging sizes, for example 40 tubs of yoghurt available in boxes of 2, 8 or 30. In these examples, the unit price of the item remains the same regardless of the quantity purchased.

School canteen: restock: level 2

As for level 1, just more challenging.

School canteen: best buy: level 1

Students choose how to order school canteen items available in a range of packaging sizes, for example 120 bottles of OJ are available in boxes of 20, 40 or 60. In these examples, notice that the unit prices may be different for packs of different sizes. Students complete the shopping list.

School canteen: best buy: level 2

As for level 1, just more challenging.

School canteen: two traders: level 1

Students are given purchase amounts of items such as bottles of water and cheese sticks. For each item on the shopping list students must check the prices and package sizes of two traders, calculate and select the cheaper deal for each item, and then compare the total cost of the items for each trader.

School canteen: two traders: level 2

As for level 1, just more challenging.

School canteen estimate and check: level 1

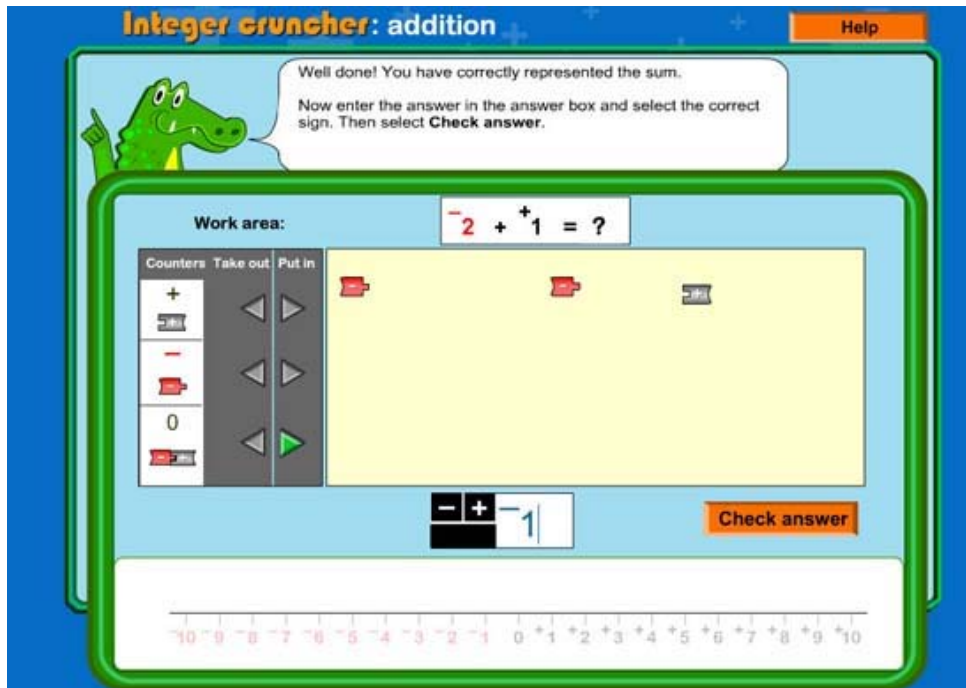
Students purchase given amounts of items such as bottles of orange juice and boxes of sultanas. They look at the shopping list and check the prices and package sizes from the price catalogues of two traders. They then estimate which trader will supply all the goods for the lowest total cost. Students can test their estimates by calculating the total cost from each price catalogue. They should notice that unit prices vary depending on the multiples in which items are sold.


School canteen: estimate and check: level 2

As for level 1, just more challenging.

Integer cruncher (Years 7–8)

The Integer cruncher series focuses on the use of counters to model the addition or subtraction of two integers. For example $-2 + +5 = +3$ or $-5 - +1 = -6$.



Learning objects	LO ID	Years
Integer cruncher: addition	1100	7–8
Integer cruncher: subtraction	1101	7–8
Integer cruncher: addition and subtraction 	585	7–8

Integer cruncher: addition

The 'Integer cruncher: addition' learning object provides an introduction to the general concepts of integer calculations and an introduction to performing integer additions. The learning object presents the students with integer addition equations, which they need to solve by placing positive and negative counters in a work space. The student enters a numeric answer and can observe the calculation on a number line. Once six equations have been correctly solved the student is presented with a summary of the equations they have solved.

Integer cruncher: subtraction

The 'Integer cruncher: subtraction' learning object provides an introduction to the general concepts of integer calculations, and an introduction to performing integer subtractions using Integer cruncher. The learning object presents students with integer subtraction equations, which they need to solve by placing positive and negative counters in a work space. The student enters a numeric answer and can observe the calculation on a number line.

Once six equations have been correctly solved the student is presented with a summary of the equations they have solved.

Integer cruncher: addition and subtraction

This is an aggregated learning object combining the two other learning objects.

Content from other sources

Exploring number (Years 6–9)

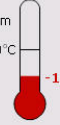
These learning objects are short digital activities that allow students to explore and practise a range of numerical concepts and operations.

Exploring integers

Calculate the temperature difference

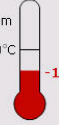
Calculate the temperature change from **Day 1** to **Day 2**.

Day 1
12:00 pm
Temp



-19°C

Day 2
12:00 pm
Temp



-15°C

Temperature Change = Day 2 - Day 1
 = (-15 °C) - (-19 °C)
 = °C

[Start the activity](#)

Description

Calculate temperature changes over a 24-hour period.

Instructions

Look closely at the temperature measurements on Day 1 and Day 2. Calculate the difference between them, and then enter the answer in the empty box. Make sure you enter the negative symbol if your answer is a temperature below 0°C. Select **Check** to see if you are right. Then select **New** to complete another problem.

Items in this group

[Calculate the temperature difference](#)
[Video](#)

Acknowledgements

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Identifiers TLF LearningObject L6544
Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Learning objects	LO ID	Years
Exploring order of operations	6543	6–9
Exploring integers	6544	6–9
Exploring exponents and scientific notation	6550	6–9
Exploring number patterns	6551	6–9
Exploring linear equations	6553	6–9
Exploring powers of 10	6548	7–9

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are presented in template format with a description and instructions. Each learning object often contains two or more separate activities or games. Some also come with a short video which provides everyday examples of the mathematical principles featured in the learning object

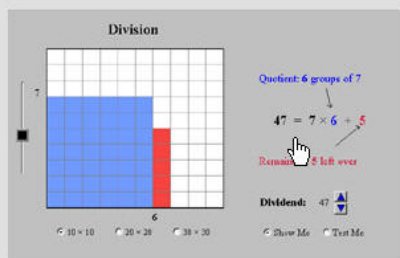
These learning objects are licensed from Alberta Education, Canada (www.learnalberta.ca).

Number manipulatives (Years P–9)

These learning objects are manipulatives that allow students to explore and practise a range of numerical concepts and operations.



Rectangle division



Explore and practise division, using blocks on a grid.

Instructions

The grid shows a big number divided by a little number. The big number is the total number of blue and red blocks. The little number is the height of the blue rectangle. The number of red blocks is the remainder (left over) when the big number is divided by the little number.

To the right of the grid, the big number is shown to be the little number times another number plus the remainder.

Change the number of pieces that the grid is divided into by using the radio buttons below it.

With the *Show Me* option selected, click and drag the slider to the left of the grid to explore the result of dividing one number by another.

Select the *Test Me* option to be given division problems to solve. Use the slider to create a picture representing the division problem. Then fill in the text boxes to the right with your answer. Click on *Check* to see if your answer is correct.

Acknowledgements

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Learning objects	LO ID	Years
Numberline arithmetic	3536	P–4
Numberline bars	3537	2–8
Diffy	4159	3–9
Rectangle division	3704	3–9
Rectangle multiplication	3503	3–9
Rectangle multiplication: integers	3504	5–9
Sieve of Eratosthenes	3545	5–9
Circle 99	3508	5–9
Circle 0	3506	6–9
Circle 3	3507	6–9
Pascal's triangle	3538	6–9

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are each presented in template format with a description and instructions.

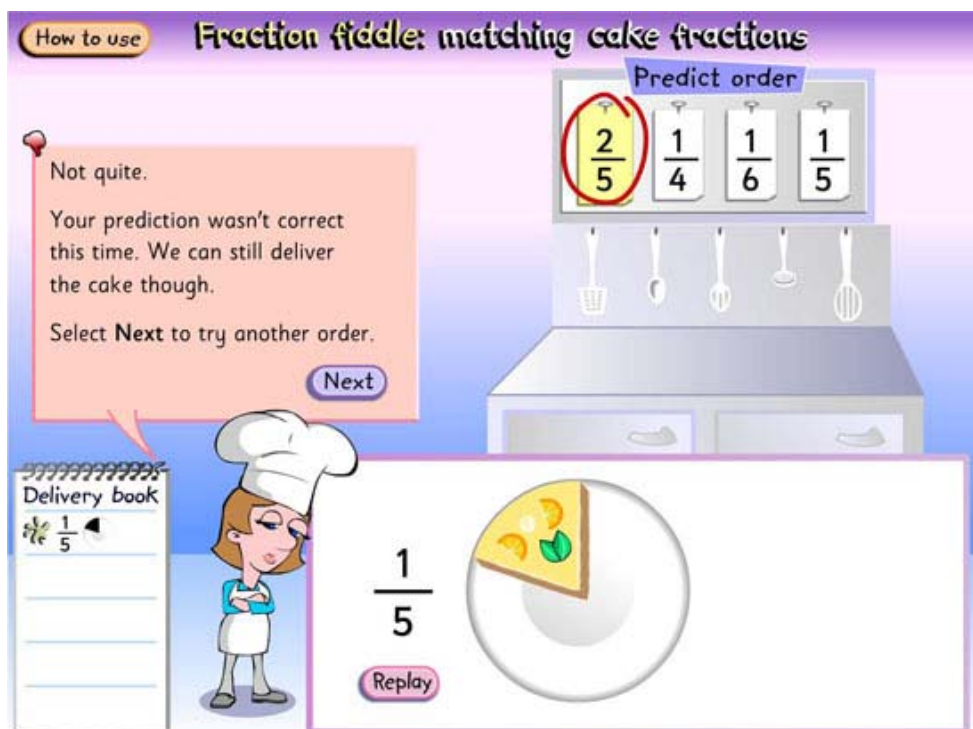
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Number: common fractions, decimal fractions, percentages

The Number: common fractions, decimal fractions, percentages learning objects released to date have are grouped into the following series.

Fraction fiddle (Years 2–6)

In the Fraction fiddle series students use dynamic tools to solve problems involving fractions. Problems include comparison of the relative size of two fractions, the ordering of fractions from smallest to biggest and adding fractions.



Learning objects	LO ID	Years
Fraction fiddle: tool	2800	3–6
Fraction fiddle: matching cake fractions	2801	2–3
Fraction fiddle: comparing unit fractions	2802	3–4
Fraction fiddle: comparing non-unit fractions	2803	3–4
Fraction fiddle: hit the apple	2804	3–5
Fraction fiddle: shoot the hoop	2805	4–6
Fraction fiddle: reach the target	2806	4–6

In each of the learning objects students first predict the answer to a problem involving fractions. They use a dynamic tool to solve the problem then see their problem-solving displayed in different formats. Visual, sound and textual feedback is provided, and guided support is provided to students experiencing difficulty. Students see the results of their problem solving in different formats including an area model, the fraction's position on a numberline and the symbolic fraction.

A notebook, which can be printed on completion of the task, automatically records the problems solved.

Randomisation of the activities supports repeated use.

Fraction fiddle: tool

Students use an open-ended interactive tool that dynamically links a diagram of rectangular region, symbolic notation and a number line.

Fraction fiddle: matching cake fractions

Fran is filling orders for cakes, not everyone wants a whole cake so she needs to match the cake orders to the cakes. Students use a circular region representation tool to find the matching symbolic fraction.

Fraction fiddle: comparing unit fractions

The hungry kiwis each ate a fraction of a worm. Students predict who ate more or who ate less. Using the fraction-making tool, students make the fractions and watch the parts of the worm appear and observe the fractions on the number line to see which one is bigger. The fractions presented are unit fractions such as $\frac{1}{2}$ and $\frac{1}{3}$.

Fraction fiddle: comparing non-unit fractions

The greedy birds each ate a fraction of a worm. Students predict who ate more or who ate less. They then make the fractions and watch the parts of the worm appear and observe the fractions on the number line to see which one is bigger. The fractions presented are non-unit fractions such as $\frac{3}{4}$ and $\frac{2}{3}$.

Fraction fiddle: hit the apple

To help an archer hit an apple target, students use a number line tool to find two fractions that will add together to make one whole.

With a given denominator (1 or both) students manipulate relative size of the two fractions to make total of one whole. Reach a target of 1.

Fraction fiddle: shoot the hoop

Students use a number line tool to find two fractions that will add together to make one whole to help shoot a ball into the hoop.

With a given numerator (or 1 num and 1 denom given) manipulate relative size of fractions to make total of one whole. Reach a target of 1.

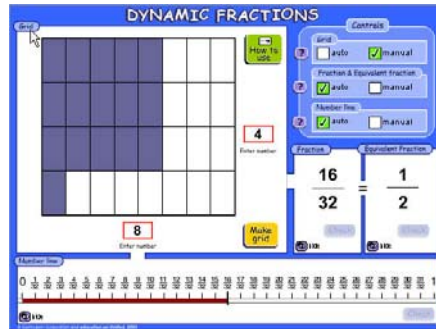
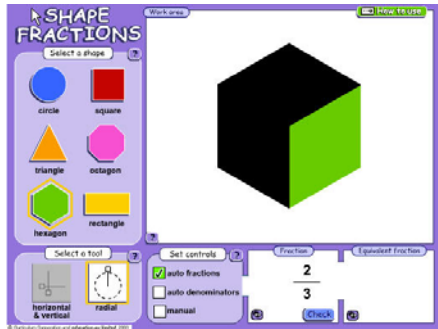
Fraction fiddle: reach the target

Students use a number line tool to find two fractions that will add together to make the target number to make the plane hit the target.

With a given denominator (no given numbers) manipulate relative size of fractions to make given total. Reach a given target less than 2 (not 1).

Dynamic tools (Years 3–6)

The Dynamic tools series, students use exploration tools designed to help students learn about fractions.



Learning object	LO ID	Years
Shape fractions	135	3–6
Dynamic fractions	134	3–6

Shape fractions

This learning object is an exploration tool that enables the user to divide simple shapes into equal parts. Students can select regions, then express the area selected as a fraction (or equivalent). They manually select fractions or choose other options to set variables displayed.

This learning object represents fractions less than or equal to 1 by creating equal-sized regions within a two-dimensional shape, and naming these parts using words and numerals in fraction notation.

Dynamic fractions

This learning object is an exploration tool that enables the user to interact with the direct relationship between the spatial, symbolic and written representations of a fraction less than 1. The alternative representations change dynamically, emphasising the equivalence between the various representations.

There are three modes of display and interaction:

Mode 1: Grid that the user can set between 1 and 10 in each of the text fields.

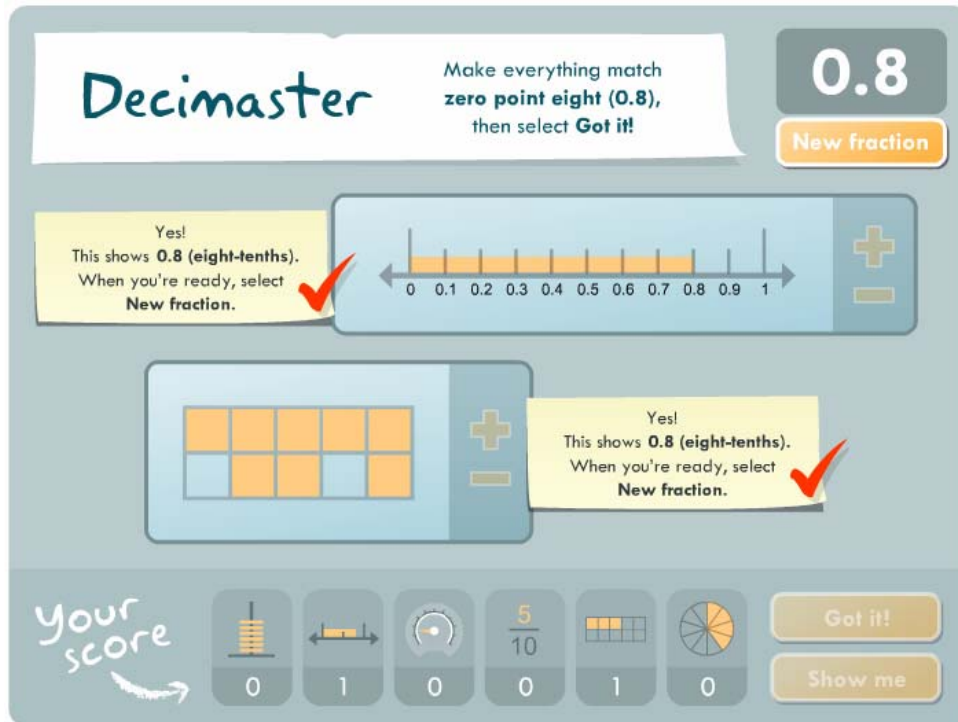
Mode 2: Grid with number line, including fractions.

Mode 3: Number line and grid, including fractions and equivalents.

If the grid is set to auto, the numerator changes automatically when regions are selected. Setting the mode to manual allows students to enter the numerator themselves. The equivalent fractions can also change automatically or be entered manually. The fractions section is split into two parts. The first part displays the fraction developed from the visual representation, while the second part displays the equivalent simplified fraction.

Decimaster (Years 3–6)

The Decimaster series demonstrates that decimal fractions can be represented in a variety of ways. Students manipulate various representations of fractions until they match a given decimal fraction.



Learning objects	LO ID	Years
Decimaster: match-up 1	1076	3–4
Decimaster: match-up 2	1077	3–5
Decimaster: match-up 3	586	4–6
Decimaster plus: match-up 1	1078	3–4
Decimaster plus: match-up 2	1079	3–5
Decimaster plus: match-up 3	1080	3–5
Decimaster collections: match-up 1	1081	3–4
Decimaster collections: match-up 2	1082	4–5
Decimaster collections: match-up 3	1083	5–6

Decimaster uses six different manipulable representations: counting frame, number line, odometer dial, common fraction, rectangular area model and circular area model.

The series has three subseries with three levels in each:

- Decimaster deals with numbers from zero to one: parts of a whole.
- Decimaster plus deals with numbers from zero to four: whole and parts of a whole.
- Decimaster collections deals with decimal fractions as part of a collection.

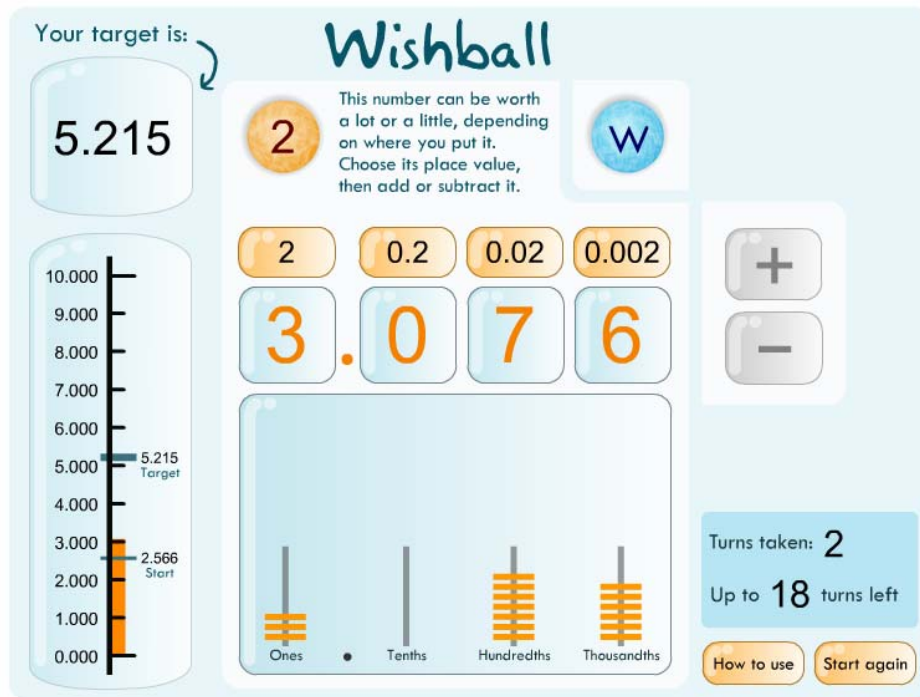
Level 1 in each subseries provides students with a decimal fraction shown both as a number and in words, as a common fraction and in another core representation (area or line representation). Students manipulate the core representation and the common fraction to match the decimal fraction.

Level 2 in each subseries allows students to choose from a range of six representations. Students may choose to work on all representations or to focus on one or two representations to improve understanding. A scorecard records their successes.

Level 3 in each subseries presents students with two randomly chosen representations at a time. Students manipulate these representations to match a decimal fraction written as a number. A scorecard records their successes.

Wishball (Years 3–6)

The Wishball series encourages thinking about place value. It also provides opportunities for mental addition and subtraction.



Learning objects	LO ID	Years
Wishball: whole numbers	867	3–4
Wishball: tenths	868	4–5
Wishball: hundredths	869	5–6
Wishball: thousandths	495	5–6
Wishball: ultimate	870	6
Wishball challenge: whole numbers	871	3–4
Wishball challenge: tenths	872	4–5
Wishball challenge: hundredths	873	5–6
Wishball challenge: thousandths	874	5–6
Wishball challenge: ultimate	875	6

Students try to reach a target number by adding or subtracting in fewer than 20 moves. The Spinner randomly serves up a digit. Before students add or subtract they first choose a place value to assign to the digit. So, if 2 is the digit served up, students can make it 2.0, 0.2, 0.02 or 0.002. Students may also refer to the number line or counting frame to help confirm the soundness or otherwise of their computations. The Wishball option, which can be used only once, allows the students to choose the digit required to finish the game. With feedback, students are challenged to develop more effective problem-solving strategies in an effort to achieve the target.

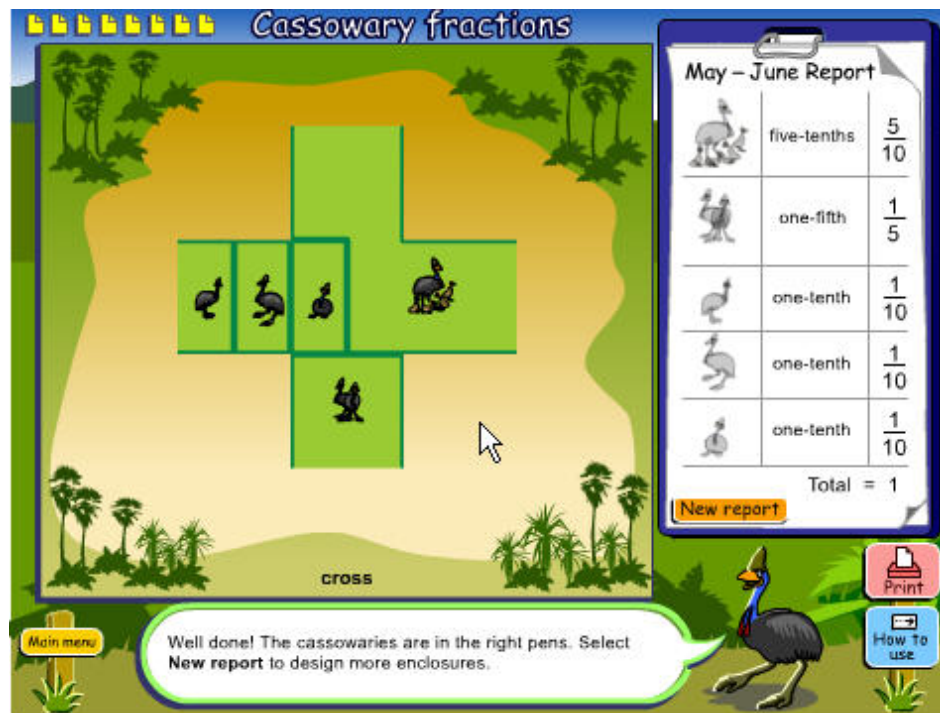
The Wishball series of learning objects comprises two subseries: Wishball and Wishball challenge. In both subseries the decimal point is placed so students can explore whole numbers, tenths, hundredths or thousandths. The 'Ultimate' versions offer random placement of the decimal point.

Both the addition (+) and subtraction (−) operators are provided for students to use for calculation. In 'Wishball challenge' students are randomly offered either the subtraction or addition operator to make their calculation.

By using the range of learning objects in this series, students realise that the same strategies for calculation apply regardless of where the decimal point is placed.

Cassowary fractions (Years 4–6)

This Cassowary fractions series uses the context of a cassowary sanctuary to further students' understanding of common fractions. Cassowaries are an endangered species of birds that live in northern Queensland.



Learning object	LO ID	Years
Cassowary fractions	155	4–6
Cassowary sanctuary	86	4–6
Cassowary ecology quiz	119	4–6

'Cassowary sanctuary' and 'Cassowary ecology quiz' contain non-TLF content. See Acknowledgements in the learning objects.

In 'Cassowary fractions', students are presented with a scenario in the form of an incident report such as 'four cassowaries sick with a virus'. Students are asked to select a geometric shape, perhaps a square, an octagon or a circle, to use to form their pens. They then choose a radial or rectangular tool to divide the shape into appropriate sections. For the incident report above, students must divide the shape into quarters. There is an emphasis on the concept of fractions being equal parts of a whole, with visual and textual feedback provided.

Once the initial fractions are selected, a new incident report appears warning that additional cassowaries must be accommodated. 'Father Cassowary and three chicks infected with a virus'. Students are directed to change their enclosure so that there are eight equal-sized pens. They then subdivide the enclosure into eighths. Once this is completed successfully, the idea of equivalent fractions is introduced—'The father cassowary and his three chicks can share a pen. Select one-half of the enclosure to show where this pen will go.' In the final section of this particular incident, students are asked to identify the symbolic representation of fraction left for each remaining cassowary.

Different incident reports require different fractions, with the most complex being twelfths. In some cases only one of the tools is available, and sometimes not all of the shapes are available.

'Cassowary sanctuary' is identical to 'Cassowary fractions' but includes the ecology quiz. This is a set of information about the cassowary such as its height compared to other birds and the number of eggs it commonly lays compared to other birds. On some of the screens there are quizzes about the facts presented. The answers to each of these quizzes are common fractions. One screen provides the student with strategies that could be employed to improve the sustainability of the cassowary. Students can select strategies they think should be employed and see the effect on the cassowary population. The effect is represented graphically.

'Cassowary sanctuary' is an aggregated learning object combining the other two learning objects.

Design briefs (Years 3–8)

This Design briefs series uses an area model and a number line to explore the relationship between and representation of all forms of fractions. Students learn about common fractions, decimal fractions and percentages by designing a park, a city, a school, a farm or a neighbourhood.



Learning objects	LO ID	Years
Design a park	120	3–5
Design your own park	121	4–6
Park fractions	126	4–6
Design a school	127	5–8
Design your own school	128	5–8
Playground percentages	133	5–8
Design a neighbourhood	122	5–8
Design a city	123	5–8
Design a farm	124	5–8
Neighbourhood fractions	125	5–8

Students are introduced to Terry the town planner, who invites them to design according to a brief. A grid is provided: 10 by 10 in the 'Design a school' and 'Design your own school' learning objects, and 10 by 20 in the others. The brief varies in specificity. In some learning objects almost all areas are specified whereas in the 'Design your own school' learning object, only a couple of sections are defined.

The brief can be described in common fractions, decimal fractions, percentages or a combination of some or all of these. The emphasis is on equivalence and representations of fractions in the area model, on symbols and on a number line.

'Park fractions' is an aggregated learning object combining the park learning objects.

'Playground percentages' is an aggregated learning object combining the school learning objects.

'Neighbourhood fractions' is an aggregated learning object combining the neighbourhood, farm and city learning objects.

Content from other sources

Exploring fractions and percentages (Years 5–9)

These learning objects are short digital activities that allow students to explore and practise a range of concepts and operations relating to fractions and percentages.

Exploring fractions

Balance the scales

Select a measuring cup and continue to click on it until the scale is balanced at $1\frac{1}{2}$

Start the activity

Description

Select a measuring cup to explore improper, mixed and equivalent fractions to obtain a target fraction.

Instructions

Select one of the four measuring cups in the green boxes on the left side of the screen. You can only use one measurement at a time. Keep selecting the measuring cup until the target measurement at the top of the screen has been reached and the scales are clearly balanced. Select **Clear** to undo your selections and to start the same task all over again. The equations underneath the scales will also show you the cup measurements and their equivalent fractions.

Select **New** to balance new scales.

Items in this group

[Balance the scales](#)
[Video](#)

Acknowledgements

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Identifiers TLF LearningObject L6542
Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Learning objects	LO ID	Years
Exploring fractions	6542	5–9
Exploring combined percentages	6545	7–9

This series contains non-TLF content. See Acknowledgements in the learning objects.

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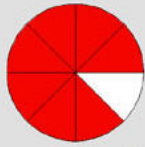
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Fraction manipulatives

These learning objects are manipulatives that allow students to explore and practise a range of concepts and operations relating to fractions.



Fractions: naming



7

/

8

Check

Name the fraction shown by the shape.

Yes, you are correct!

New Fraction

Name fractions shown by shaded parts on shapes.

Instructions

Indicate the number of coloured parts in the picture (numerator)

Count how many parts of the whole unit are coloured and enter that number in the top (numerator) box.

Indicate the total number of parts in the picture (denominator)

Count how many parts make up the whole unit and enter that number in the bottom (denominator) box.

Find out if your fraction name matches the picture

Find out if your fraction name corresponds to the picture by clicking on the *Check* button.

Ask for a new fraction to name

To ask for a new fraction to name, click on the *New Fraction* button.

Acknowledgements

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Learning objects	LO ID	Years
Fraction pieces	3520	P–3
Fractions: visualising	3526	P–3
Fractions: naming	3523	1–3
Fractions: parts of a whole	3524	1–3
Fractions: equivalent	3651	2–6
Fractions: comparing	3521	3–8
Fractions: rectangle multiplication	3525	3–8

This series contains non-TLF content. See Acknowledgements in the learning objects.

These manipulatives are each presented in template format with a description and instructions.

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Algebra

The Algebra learning objects released to date have are grouped into the following series.

Monster choir (Years P–3)

The Monster choir series allows students to explore patterning using visual and auditory elements to create patterns, extend patterns, create equivalent patterns and complete patterns.



Learning objects	LO ID	Years
Monster choir: making patterns	1056	P–1
Monster choir: missing monsters	1057	P–2
Monster choir: look and listen	494	2–3

Monster choir: missing monsters

Students complete a visual pattern based on a given pattern comprising different shapes, with the assistance of audio support. By selecting different monsters to represent each of the different shapes, the student creates an equivalent sequence. They then replicate this to extend and hear the whole pattern played and performed by the monster choir.

Monster choir: making patterns

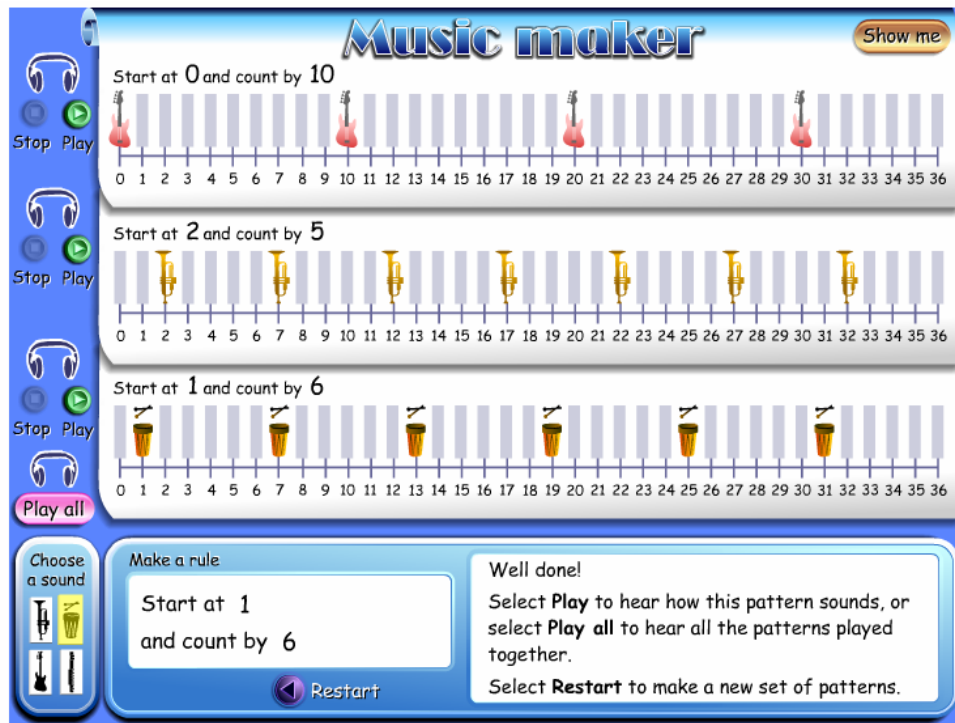
Students create visual and sound patterns for the monsters to sing. First they select two, three or four monsters to sing the first part of their pattern. This sequence is shown using a symbolic representation and students can hear the sound of the monster chosen. Students repeat this sequence to create the whole pattern. The monster choir plays and performs the pattern.

Monster choir: look and listen

Students create a sound pattern based on a given visual pattern comprising different shapes. The student determines the first part of the pattern, which is shown as a sequence of two or three different shapes. By listening to, and selecting different monsters, the student creates an equivalent sequence. They then use auditory memory skills to replicate the sequence to extend the pattern. Feedback is given after they have made an attempt.

Musical number patterns (Years 1–6)

The Musical number patterns series develops understanding that patterns consist of repeating elements or groups of elements, are predictable and can be represented in different forms.



Learning objects	LO ID	Years
Musical number patterns: musical counter	1063	1–2
Musical number patterns: music maker	589	2–3
Musical number patterns: odds and evens	1064	3–4
Musical number patterns: musical times	1065	3–4
Musical number patterns: the challenge	1067	5–6

In each of the learning objects, students use a counting rule to record a number pattern on a number line. They then listen to the sound pattern created by the sequence of numbers

Musical number patterns: musical counter

Students are given a rule in words to display on a musical number line to show the pattern. They can then watch and listen to the pattern formed on the number line. Up to three number lines and rules can be made and played separately or together.

Musical number patterns: music maker

Students create a rule by selecting a starting number and a 'count by' number. They then indicate this rule on a musical number line to show the pattern and can watch and listen to the rule on the number line. Up to three number lines and rules can be made and played separately or together.

Musical number patterns: odds and evens

Students are posed a problem based around odd or even numbers. They then create a rule to display on the number line by selecting a start number and a 'count by' number. The results can be observed on two musical number lines.

Musical number patterns: musical times

Students are presented with a pattern on a number line and required to create a rule for the pattern. The results are shown on a second number line.

Musical number patterns: the challenge

Students are presented with a pattern on a number line and are required to create a rule for the pattern. A second problem based on the first pattern is then presented and students are asked to adjust the rule accordingly.

Hopper (Years 3–6)

The Hopper series enables students to investigate patterns in whole numbers and decimals. The learning objects are also intended to assist students with their estimation and counting skills in decimals. Students are encouraged to understand counting patterns like 3.09, 3.1, 3.11; or 4.01, 4, 3.99. Ideas of algebraic thinking are introduced in a non-threatening way, using words rather than the symbolic notation that often confuses students.

Learning objects	LO ID	Years
Hopper: whole numbers	1084	3–4
Hopper: tenths	1085	4–5
Hopper: hundredths	587	5–6
Hopper: ultimate	1086	5–6
Hopper challenge: whole numbers	1087	6
Hopper challenge: tenths	1088	6
Hopper challenge: ultimate	1090	6

Students visualise a pattern of jumps made by a frog (the Hopper) according to a jump plan established partially by students. Students select the jump size and the direction of each jump: forwards or backwards. The number of jumps and the starting point is generated by the learning object. The jump plan is a rule or expression that promotes algebraic thinking. In this way students are introduced to basic mathematical representations of rules as a precursor to algebra. The pattern work introduces students to algebraic thinking and the effect of the multiplication and addition operations. The idea that patterns can be represented by a rule, on a number line and also as a diagram can be explored. Students are also exposed to the idea that the same visual pattern can be made using more than one rule.

There are two subseries: Hopper and Hopper challenge. Additional activities are provided to develop students' visual pattern recognition for each jump size and to encourage students to start thinking in algebraic forms.

Hopper: whole numbers

Students set up a jump plan for the Hopper by selecting a jump size and direction. The starting point is generated randomly on a grid of whole numbers. Students estimate the finish point and test this estimate by watching the Hopper jump.

Hopper: tenths

Students set up a jump plan for the Hopper by selecting a jump size and direction. The starting point is generated randomly on a grid of numbers expressed as tenths. Students estimate the finish point and test this estimate by watching the Hopper jump.

Hopper: hundredths

Students set up a jump plan for the Hopper by selecting a jump size and direction. The starting point is generated randomly on a grid of numbers expressed as hundredths. Students estimate the finish point and test this estimate by watching the Hopper jump.

Hopper: ultimate

Students are presented with randomly selected problems from each of 'Hopper: whole numbers', 'Hopper: tenths' and 'Hopper: hundredths'. Students set up a jump plan for the Hopper by selecting a jump size and direction. The starting point is generated randomly on a grid of numbers expressed in the selected interval size. Students estimate the finish point for the jump plan and test this estimate by watching the Hopper jump.

Hopper challenge: whole numbers

The Hopper challenge subseries develops students' ability to estimate the size of jump plan (multiplication exercise). Students set up a jump plan for the Hopper by selecting a jump size and direction. The ending point is generated randomly on a grid of whole numbers. Students estimate which of three possible starting points for the jump plan will lead to this ending point and tests this estimate by watching the Hopper jump.

Hopper challenge: tenths

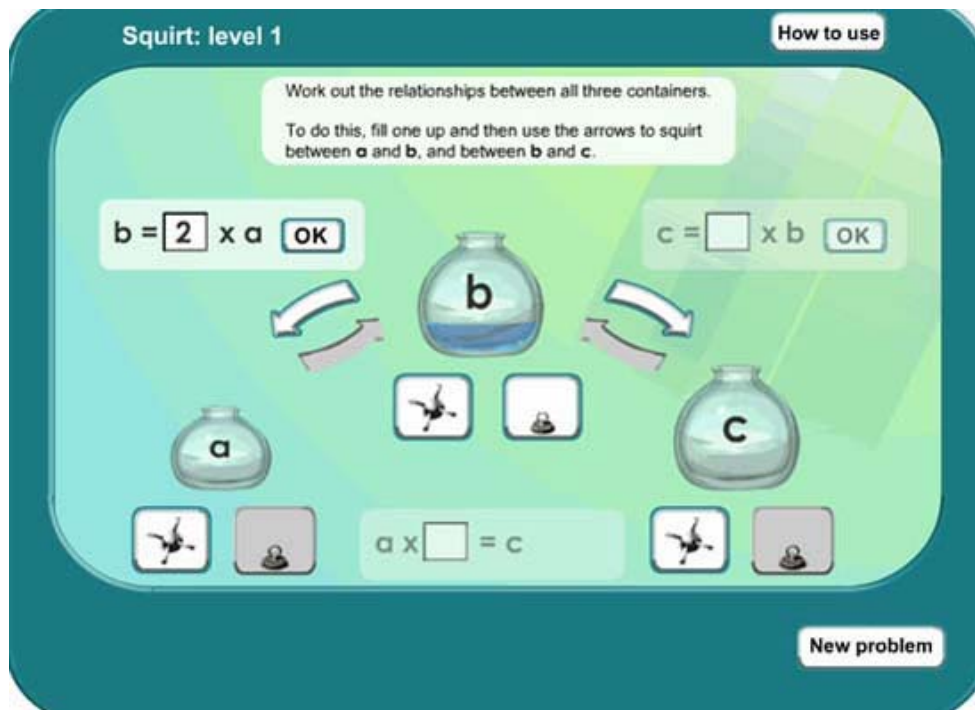
The Hopper challenge subseries develops students' ability to estimate the size of jump plan (multiplication exercise). Students set up a jump plan for the Hopper by selecting a jump size and direction. The ending point is generated randomly on a grid of numbers expressed as tenths. Students estimate which of three possible starting points for the jump plan will lead to this ending point and test this estimate by watching the Hopper jump.



Hopper challenge: ultimate

The 'Hopper challenge' subseries develops students' ability to estimate the size of jump plan (multiplication exercise). Students are presented with randomly selected problems from each of 'Hopper: whole numbers' and 'Hopper: tenths'. Students set up a jump plan for the Hopper by selecting a jump size and direction. The ending point is generated randomly on a grid of numbers expressed in the selected interval size. Students estimate which of three possible starting points for the jump plan will reach this ending point and test this estimate by watching the Hopper jump.

Squirt (Years 4–8)

The Squirt series explores the relationships between capacities of various sized containers. Students are asked to express proportional relationships algebraically by filling a container and squirt liquid between containers to establish relationships between a & b , b & c and a & c . For example; $2a + 6b = 3c$.



Learning objects	LO ID	Years
Squirt: two containers: level 1	1994	4–6
Squirt: two containers level 2	1995	4–6
Squirt: two containers 	1993	4–6
Squirt: three containers: level 1	1991	6–8
Squirt: three containers: level 2	1992	6–8
Squirt: three containers 	1990	6–8
Squirt: three containers: complex proportional relationships	1996	6–8

Squirt: two containers

'Squirt: two containers' is an aggregated learning object combining Squirt: two containers level 1 and level 2 in a sequence. Students express proportional relationships using two containers. These learning objects develop students' ability to express equations algebraically and understanding of multiplicative relationships. Once six equations have been correctly solved the student is presented with a summary of the equations they have solved.

Squirt: two containers: level 1

'Squirt: two containers: level 1' learning object contains less complex equations than level 2 of this sub-series. Students express proportional relationships using two containers.

Squirt: two containers: level 2

'Squirt: two containers: level 2' learning object contains more complex equations than level 1 of this sub-series. Students express proportional relationships using two containers.

Squirt: three containers

'Squirt: three containers' is an aggregated learning object combining Squirt: three containers level 1 and level 2 in a sequence. Students express proportional relationships using three containers to represent quantitative relationships. These learning objects develop student understanding of proportional reasoning. Once six equations have been correctly solved the student is presented with a summary of the equations they have solved.

Squirt: three containers: level 1

'Squirt: three containers: level 1' learning object contains less complex equations than level 2 of this sub-series. Students express proportional relationships using three containers.

Squirt: three containers: level 2

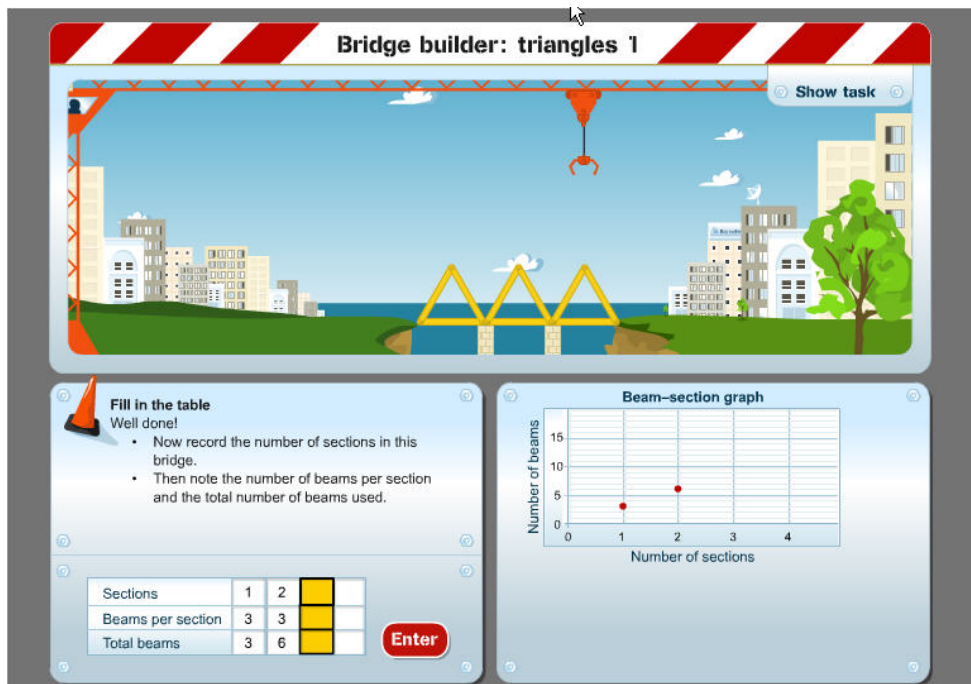
'Squirt: three containers: level 2' learning object contains more complex equations than level 1 of this sub-series. Students express proportional relationships using three containers.

Squirt: three containers: complex proportional relationships

'Squirt: three containers: complex proportional relationships' stand-alone learning object is the most complex in the Squirt series. Students use ratios and proportions to represent complex quantitative relationships and solve complex problems using or involving ratios. Students express proportional relationships using three containers.

Bridge builder (Years 5–9)

The Bridge builder series uses a bridge-building context to explore the links between spatial and number patterns, tables of values, graphs and rules expressed in words or as algebraic formulae.



Learning objects	LO ID	Years
Bridge builder: triangles 1	1922	5–9
Bridge builder: triangles 2	1923	5–9
Bridge builder: quadrilaterals	1924	5–9
Bridge builder: complex squares	1925	5–9
Bridge builder: complex pentagons	1926	5–9

In each of the learning objects in this series, animations show bridges with increasing numbers of spans being constructed. The task is to identify how many beams are required for the bridges of different sizes (number of sections) and different types of sections. This series of learning objects is designed to assist the student to identify and use the characteristics of linear number patterns. The objects lead users to construct algebraic rules, stepping beyond additive approaches and interpretations of the patterns to more sophisticated multiplicative and algebraic strategies. The complexity of the formulae ranges from multiplicative ($y = mx$) to algebraic ($y = mx + c$) forms.

The learning objects progressively increase in difficulty.

Bridge builder: triangles 1

Students build bridges by adding triangular sections (each made up of three beams) with increasing widths (increasing by one section each time).

Bridge builder: triangles 2

Students build bridges by adding triangular sections (each made up of three beams) with increasing widths (increasing by at least one section each time).

Bridge builder: quadrilaterals

Students build bridges by adding quadrilateral sections (each made up of four beams).

Bridge builder: complex squares

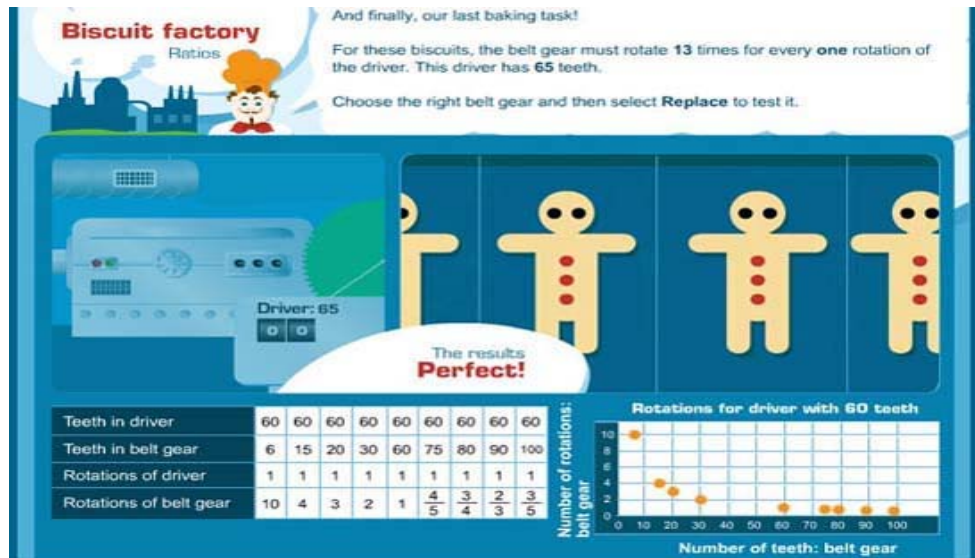
Students build bridges by adding regular sections (each made up of several beams).

Bridge builder: complex pentagons

Students build bridges by adding pentagonal sections (each made up of five beams).

Biscuit factory (Years 5–9)

The focus of the Biscuit factory series is on the mathematical skills and mental calculations (recall of multiplication and division facts, recognition of common factors and multiples) associated with using ratios in a problem-solving context.



Learning objects	LO ID	Years
Biscuit factory: ratios	2371	5–9
Biscuit factory: complex ratios	2372	5–9
Biscuit factory: gear direction	2283	5–9
Biscuit factory: two-gear system	2373	5–9
Biscuit factory: three-gear system	2374	5–9
Biscuit factory: gears	2375	5–9

In the context of a biscuit making factory, the student chooses gear wheels of different sizes (determined by number of teeth) to achieve different cooking times (conveyor belt speed through the oven). The purpose is to progress student thinking from counting techniques to the important aspects associated with multiplicative thinking. Feedback to the student is designed with this transition in mind.

The biscuit factory: ratios

Students explore and describe the ratio relationships between gears of varying size.

The biscuit factory: complex ratios

Students explore and describe the complex ratio relationships between gears of varying size.

The biscuit factory: gear direction

Students use simple gear chains to understand direction as it relates to gears.

The biscuit factory: two-gear system

Students configure a set of two-gear systems.

The biscuit factory: three-gear system

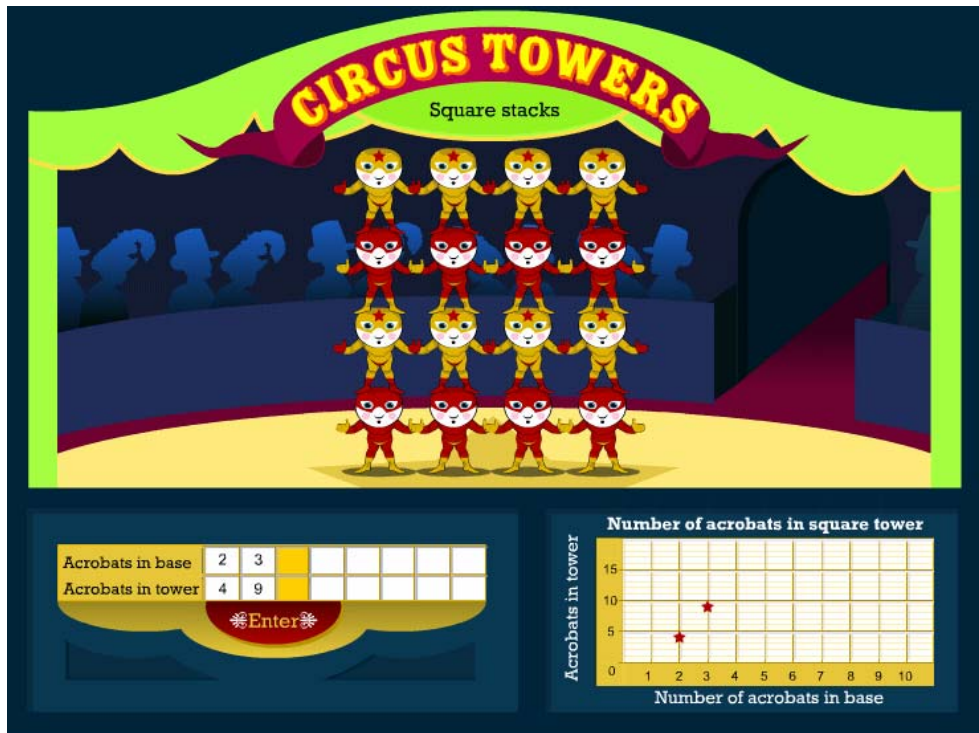
Students configure a set of three-gear systems.

The biscuit factory: gears

Students configure gear systems to output specified speeds.

Circus towers (Years 7–9)

The Circus tower series uses a circus context in which acrobats make human towers of different shapes to introduce students to number patterns arising from spatial patterns.



Learning objects	LO ID	Years
Circus towers: square stacks	1935	7–9
Circus towers: triangular towers	1936	7–9
Circus towers: triangular prisms	1937	7–9
Circus towers: rectangular prisms	1938	7–9
Circus towers: square pyramids	1939	7–9

This series is designed to assist students identify and describe the relationship between different representations of spatial patterns as patterns of numbers; in tables; as graphs; in words and using symbols in mathematical formulae. In the simple cases, students are assisted to develop multiplicative and algebraic formulae, while in the more complicated patterns, formulae are presented and used. The learning objects introduce students to non-linear graphs arising from figurate numbers such as triangular and square numbers, and prisms and pyramids with triangular and square bases.

Circus towers: square stacks

Students work out how many acrobats are needed to form square-shaped human towers. They start by building a square tower with four acrobats: two acrobats in the base layer and two acrobats standing on their shoulders.

Circus towers: triangular towers

Students work out how many acrobats are needed to form triangle-shaped human towers. They start by building a triangle with three acrobats: two acrobats in the base layer and one acrobat standing on their shoulders.

Circus towers: triangular prisms

Students work out how many acrobats are needed to form prism-shaped human towers. They start by building a triangular prism with six acrobats: three acrobats in the base layer and three acrobats standing on their shoulders.

Circus towers: rectangular prisms

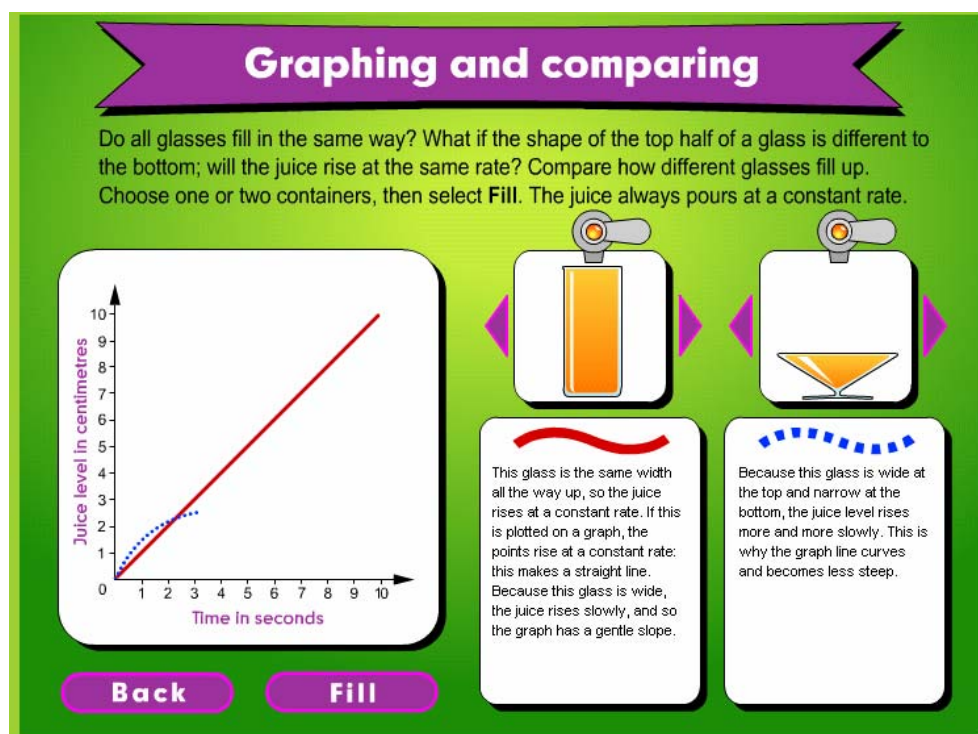
Students work out how many acrobats are needed to form pyramid-shaped towers. They start by building a triangular pyramid with four acrobats: three acrobats in the base layer and one acrobat standing on their shoulders.

Circus towers: square pyramids

Students work out how many acrobats are needed to form pyramid-shaped human towers. They start by building a square pyramid with eight acrobats: four acrobats in the base layer and one acrobat standing on their shoulders.

Filling glasses (Years 6–9)

In the Filling glasses series, students observe, identify and describe the relationship between the depth of liquid in a vessel and the shape of the vessel when it is being filled at a uniform rate of flow. Graphs (depth of liquid in the vessels against time) are used to represent the relationships between depth and vessel shape.



Learning objects	LO ID	Years
Filling glasses: find the right glass	1105	6–9
Filling glasses: find the right graph	1106	6–9
Filling glasses: create the right glass	761	6–9
Filling glasses: create the right graph	760	6–9
Filling glasses: graphing and comparing 🎨	759	6–9

Filling glasses: find the right glass

The student predicts and selects appropriate glasses to represent randomly presented graphs. This is a matching exercise where the student is required to choose an appropriate glass to match a randomly selected graph.

Filling glasses: find the right graph

This is a matching exercise where the student is required to choose an appropriate graph to match a randomly selected glass. The student needs to match both elements to match to fill the glass successfully.

Filling glasses: create the right glass

'Filling glasses: create the right glass' learning object extends the matching process by allowing the student to create their own glass from preset components (top and bottom parts) to match to a randomly presented graph.

Filling glasses: create the right graph

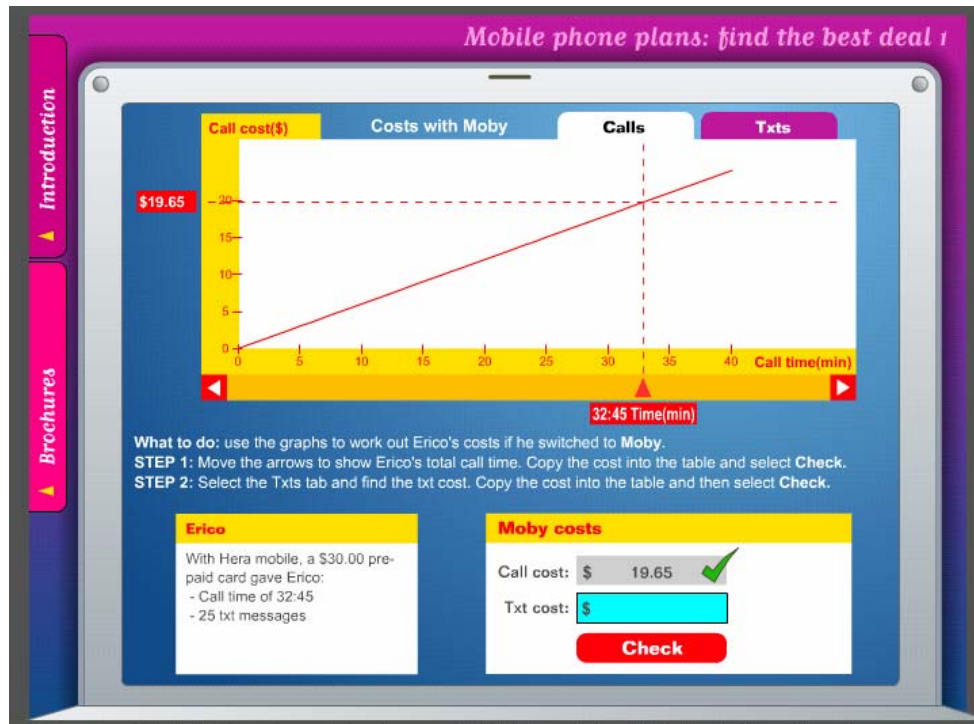
'Filling glasses: create the right graph' learning object extends the matching process by allowing the student to create their own graph from preset components to match randomly presented glasses formed from a set of top and a bottom parts.

Filling glasses: graphing and comparing

This is an aggregated learning object combining the four other learning objects in a series.

Mobile phone plans (Years 8–9)

The Mobile phone plans series explores the mathematical concepts of cost estimates, data analysis, cost time graphs, line graphs and tables.



Learning objects	LO ID	Years
Mobile phone plans: find the best deal 1	762	8–9
Mobile phone plans: find the best deal 2	763	8–9
Mobile phone plans: find the best deal 3	1107	8–9
Mobile phone plans: peak and off-peak	1108	8–9
Mobile phone plans: one company	1109	8–9
Mobile phone plans: several companies	1110	8–9

These objects deal with some of the complexities of comparing costs. They introduce the student to ways of analysing the costs associated with some different mobile phone plans using line graphs. Students interpret patterns to make predictions and comparisons between different plans using graphs to analyse and compare the costs associated with different plans.

The learning objects in the series become progressively more difficult as the number of options and alternatives increase.

Mobile phone plans: find the best deal 1

Students compare monthly costs of a current prepaid plan for different users with costs of a new phone company. Students interpret patterns and recommend which users should change to a new company calling plan.

Mobile phone plans: find the best deal 2

Students compare monthly prepaid plans offered by three companies for a range of users with different calling patterns. Students analyse the given data and recommend the cheapest option for each user.

Mobile phone plans: find the best deal 3

Students compare monthly prepaid plans offered by three companies for a range of users with different calling patterns. The plans include discounted rates for calls to subscribers of the same company. Students analyse the given data and recommend which user should change to which company.

Mobile phone plans: peak and off-peak

Students compare monthly costs on two different calling plans (peak and off-peak) for a range of users with different calling patterns. Students analyse the given data and recommend the cheapest option for each user.

Mobile phone plans: one company

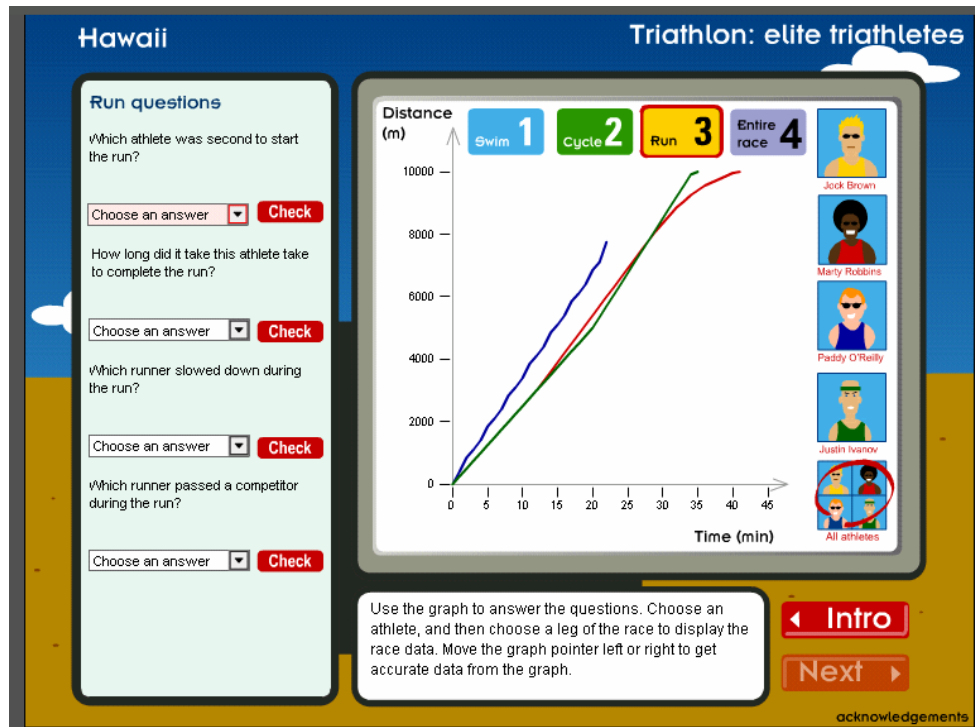
Students compare monthly costs on three different calling plans for a range of users with different calling patterns offered by a company. Students recommend the cheapest option for each user.

Mobile phone plans: several companies

Students compare monthly costs for a range of users using three similar plans offered by three different companies. Students recommend the cheapest option for each user.

Triathlon (Years 6–9)

The Triathlon series explores data analysis, distance–time graphs, distances, gradients, line graphs, number patterns and speed.



Learning objects	LO ID	Years
Triathlon: distance-time graphs	757	8–9
Triathlon: triathlete	758	8–9
Triathlon: elite triathletes	1103	6–9
Triathlon: the course	1104	8–9

This series contains non-TLF content. See Acknowledgements in the learning objects.

The activities focus on the use of distance–time graphs to represent the performance of an athlete in the three disciplines of the triathlon event: swimming, cycling, running. Students are introduced to the significance of:

- axes (what they represent)
- the graph line (using a single athlete)
- slope of line – as indication of speed
- straight line – as an indication of an unchanging distance with time still elapsing
- interpreting graphs
- determining average speed
- relative scale sizes
- graph lines of two athletes and their significance
- double axes/scale graphs, the plotting of two different sets of data on the same graph (in this case altitude).

Triathlon: distance–time graphs

'Triathlon: distance–time graphs' learning object covers the basic attributes of distance–time graphs using the performances of a triathlon athlete as an example. Students are introduced to the significance of slopes and speed.

Triathlon: triathlete

Students analyse the performance of a single athlete (either male or female) in one of two locations (Hawaii and Auckland) to check facts that are presented to them against the athletes' performances as shown in a graph format.

When they have completed their fact checking, students complete a report using the facts they have established from the graphs.

Triathlon: elite triathletes

Students analyse and compare the performances of four athletes (either male or female) in one of four locations (Hawaii, Auckland, Sydney and Perth) to check facts that are presented to them against the athletes' performances as shown in a graph format.

When they have completed their fact checking, students complete a report using the facts they have established from the graphs.

Triathlon: the course

Students analyse and compare the performances of an athlete using two graphs, distance–time and distance–altitude. They check facts that are presented to them that require an understanding and interpretation of the two graphs, separately and together.

When they have completed their fact checking, students complete a report using the facts they have established from the graphs

Lifting loads (Years 8–9)

The Lifting loads series enables students to explore the mathematical relationship between four variables in a practical science context using a pulley system.



Learning objects	LO ID	Years
Lifting loads: force?	4059	8–9
Lifting loads: reducing force	4060	8–9
Lifting loads: adding pulleys	4061	8–9
Lifting loads: pulling ropes	4062	8–9
Lifting loads: challenge	4063	8–9

In the Lifting load series, which progressively increases in difficulty, students explore the relationship between mass, force, number of pulleys and length of rope in pulleys systems in lifting tasks. Animated feedback is provided for successful completion of each lifting task. Prompts assist students where difficulties are experienced.

Lifting loads: force?

In 'Lifting loads: force?' students are presented with four lifting tasks, where the students select the correct minimum amount of force required to lift the different crates using only one pulley.

Lifting loads: reducing force

In 'Lifting loads: reducing force' students are presented with 12 lifting tasks. Students complete the Lift results table, working through all combinations of mass and number of pulleys to complete the task, selecting the correct minimum amount of force to lift the load.

Lifting loads: adding pulleys

In 'Lifting loads: adding pulleys', students are presented with four lifting tasks. Students complete the Lift results table. They must use one to four pulleys to lift the fixed load and record the minimum force used.

Lifting loads: pulling ropes

In 'Lifting loads: pulling ropes', students are presented with four lifting tasks. Students complete the Lift results table. They must use one to four pulleys to lift the fixed load with a fixed amount of force and record the length of rope that passes through the force machine.

Lifting loads: challenge

Students explore their understanding of the relationship between mass, force, number of pulleys and length of rope in pulleys systems in lifting tasks. Given the values of two of the four variables, students work out the values of the other two in order to complete lifting tasks. A quiz tests understanding of the concepts. Random generation of variables supports repeated use.

An introduction to pulleys and their uses is included in this learning object.


Content from other sources

Exploring Algebra (Years 6–9)

These learning objects are short digital activities that allow students to explore and practise a range of concepts and operations relating to algebra.

Exploring algebra

Determine the profit



The DJ had \$99 in Revenue. Click **Next** to continue.

$R = 9n$

$R = 9 (11)$ ✓

Revenue = \$ 99 ✓

[Next](#)

[Start the activity](#)

Acknowledgements


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 Identifiers TLF LearningObject L6552
 Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Description


Determine revenue and expenses using algebraic equations. Calculate overall profit.

Instructions

Work out how much profit a disc jockey makes. First, fill in the highlighted box with the correct number to complete the equation for revenue. Select **Check** to see if you are right. Then select **Next** to work on the equation for expenses. Finally, work out the total profit or loss, and enter the correct number in the box. Use the graph on the left to help you. Select **New** to complete another equation.



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Learning objects	LO ID	Years
Exploring algebra	6552	6–9
Exploring the laws of exponents	6549	7–9

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are presented in template format with a description and instructions. Each learning object often contains two or more separate activities or games. Some also come with a short video provides everyday examples of the mathematical principles featured in the learning object.

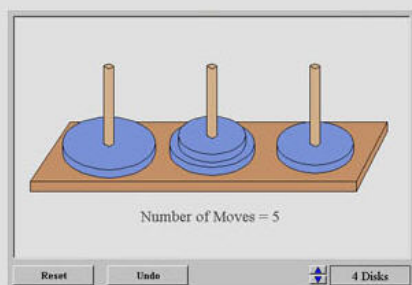
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Algebra manipulatives (Years P–9)

These learning objects are manipulatives that allow students to explore and practise a range of concepts and operations relating to algebra.



Towers of Hanoi



Move the stack of disks from one peg to another with as few moves as possible.

Instructions

- You may move only one disk at a time.
- You may not stack larger disks on top of smaller disks.

Move a disk

Click and drag the top disk on one peg to another peg.

If the disk is smaller than the top disk on the peg you select, the disk will remain on the peg. Otherwise the disk will snap back to the original peg. Each move will be added to the counter showing the number of moves you have made in the current problem.

Undo last move

Click on the *Undo* button.

The last disk moved will return to its previous peg.

The counter showing the number of moves you have made in the current problem will minus one move.

Choose a problem with a different number of disks

Acknowledgements

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Learning objects	LO ID	Years
Colour patterns	3516	P–3
Attribute trains	3551	4–9
Tower of Hanoi	4158	4–9
Algebra balance scales [Windows version]	3509	6–9
Algebra balance scales: negatives	3510	6–9
Coin problem	3514	6–9
Grapher	3531	7–9
Function machine	3527	4–9

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are each presented in template format with a description and instructions.

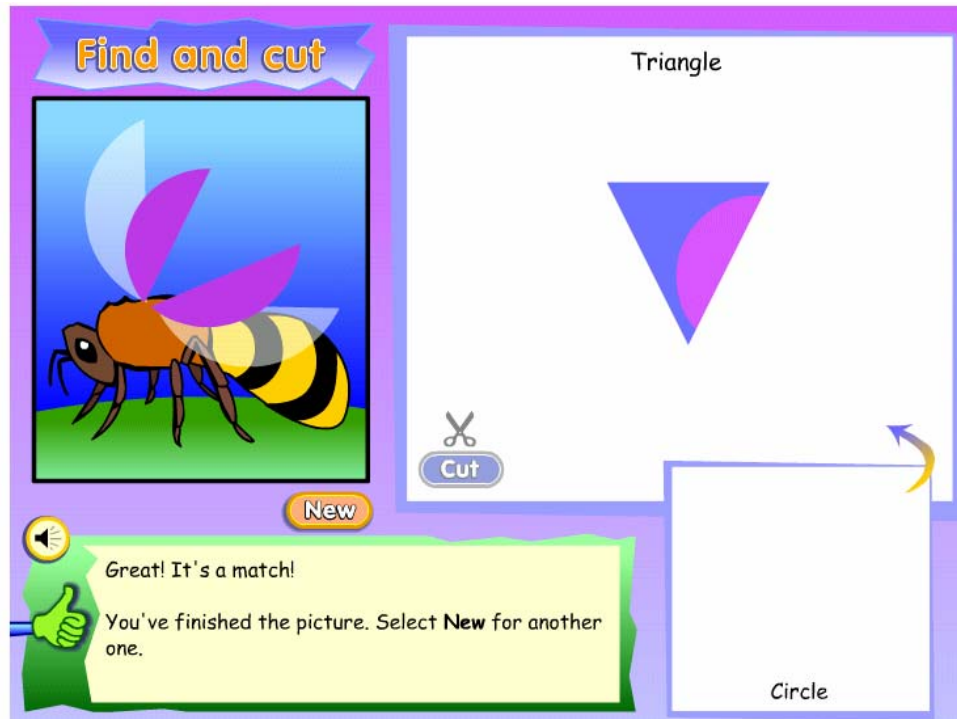
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Space

The Space learning objects released to date have are grouped into the following series.

Shape overlays (Years P–4)

The Shape overlays series requires the student to manipulate 2D shapes, by sliding and overlapping, to create other 2D shapes.



Learning objects	LO ID	Years
Shape overlays: picture studio	1071	P–4
Shape overlays: find and cut	752	P–2
Shape overlays: find, cut and turn	1072	1–2
Shape overlays: picture puzzle	1073	3–4

'Shape overlays: picture puzzle' contains non-TLF content. See Acknowledgements in the the learning object

Tasks such as making a specified shape to complete a picture puzzle require the student to consider the properties of the two original shapes and visualise how the two shapes may be overlapped to create the properties needed for the new shape.

The level of difficulty is increased by using more complex shapes, increasing the number of shapes to choose from and using the option to rotate shapes.

Shape overlays: picture studio

'Shape overlays: picture studio' is an exploratory learning object in which the student can select two shapes from four regular shapes then slide the shapes over each other to create another intersecting shape. This shape is cut out, able to be rotated and arranged to create their own picture. For students who need a starting point, there are a few ideas to copy from. Additional fun elements are available to add life to pictures if required.

Shape overlays: find and cut

The student is presented with a missing shape in a partially covered picture. To find the missing shape and see the final picture, the student slides a given 2D shape over a fixed 2D shape. They cut the shape to check that they are correct. When they have matched the missing piece the picture is revealed.

Shape overlays: find, cut and turn

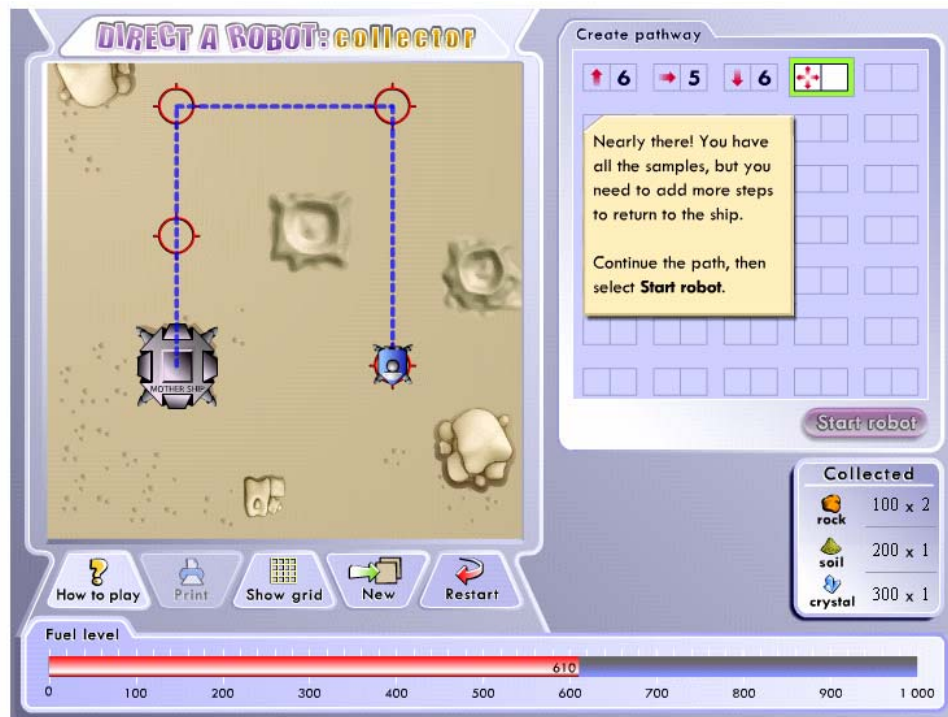
The student is presented with a missing shape in a partially covered picture. To find the missing shape and see the final picture, the student selects from two given 2D shapes (including obtuse triangle, pentagon, trapezium), and slides it over a given fixed 2D shape. They cut and rotate the shape to match the missing piece and its orientation to see the picture revealed.

Shape overlays: picture puzzle

The student is presented with a missing shape in a partially covered picture. To find the missing shape and see the final picture, the student select from three 2D shapes (including scalene triangle, rhombus and pentagon) and slides it over a fixed 2D shape. They cut and rotate the shape to match the missing piece and its orientation to see the picture revealed.

Direct a robot (Years 2–4)

In the Direct a robot series, students interpret diagram features as 2D representations of a 3D environment in a game format.



Learning objects	LO ID	Years
Direct a robot: collector	753	2–4
Direct a robot: which way?	1074	2–4
Direct a robot: how far?	1075	2–4

Students program a pathway using direction and number of distance units to enable the robot to collect samples on the surface of a planet. The learning objects require students to use a map of a planet's surface to represent location and movement of a robot using direction (left, right, forward, back) and distance travelled. The student must visualise the pathway needed to collect the maximum number of samples in the minimum number of distance units moved. This learning object develops students' understanding of the concepts 2D representations of 3D environments, relative position and relative direction.

Direct a robot: collector

Students program a pathway by selecting the direction and number of units the robot will move. The aim of the game is to create a pathway around the obstacles, collect as many samples as possible (each having a value attached) and return to the mother ship using the least amount of fuel. A hidden grid is revealed to give help with determining units.

Direct a robot: which way?

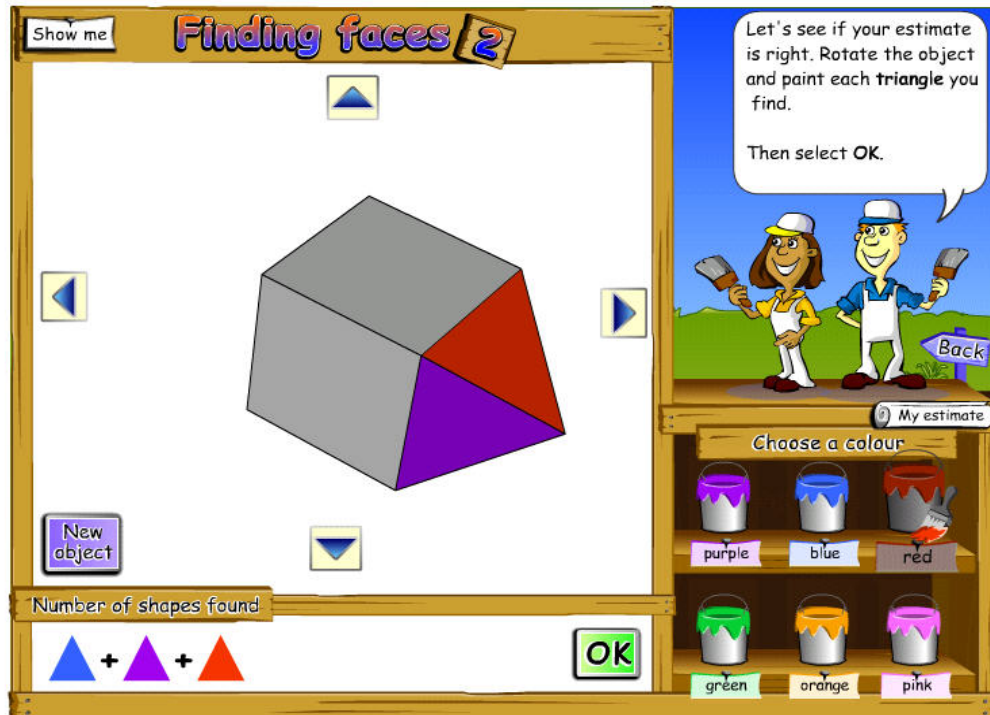
Students are presented with a plan of the surface of a planet. There are a number of samples to be collected. Part of the route has been predetermined but the directions are missing. Students select the direction of each series of moves needed to collect the samples and return to the mother ship.

Direct a robot: how far?

Students are presented with a plan of the surface of a planet. There are a number of samples to be collected. Part of the route has been predetermined but the number of units for the moves are missing. Students select the numbers of units needed to complete the pathway, collect the samples and return to the mother ship.

Face painter (Years 2–5)

The Face painter series enables students to explore the properties of, and relationship between, 2D shapes (polygons) and 3D objects (polyhedrons) by visualising the shapes of the faces of objects, including those distorted by perspective and hidden from view.



Learning objects	LO ID	Years
Face painter: finding faces 1	1068	2–3
Face painter: finding faces 2	653	3–4
Face painter: locating faces	1069	4–5
Face painter: predicting faces	1070	4–5

The Face painter series of learning objects gives students the opportunity to view and rotate 3D objects to:

- discover various properties of 2D and 3D shapes
- discover that the appearance of an object can change with varying viewing points
- visualise relationships between 2D figures and 3D objects.

Students find given 2D shapes on a 3D object. They can look at the 3D object from all perspectives and identify the 2D faces.

The controlled way in which the object must be rotated around horizontal and vertical axes provides a more systematic approach to the exploration of the structure of the shapes than would normally be possible through physical handling of the objects.

Face painter: finding faces 1

Students estimate how many of a specific 2D shape can be found on a given simple 3D object. They then rotate the 3D object to identify each instance of the 2D shape by painting it. Numbers of shapes correctly painted are automatically recorded and updated.

Face painter: finding faces 2

Students estimate how many of a specific 2D shape can be found on a given complex 3D object. They then rotate the 3D shape to identify each instance of the 2D shape by painting it. Numbers of shapes correctly painted are automatically recorded and updated.

Face painter: locating faces

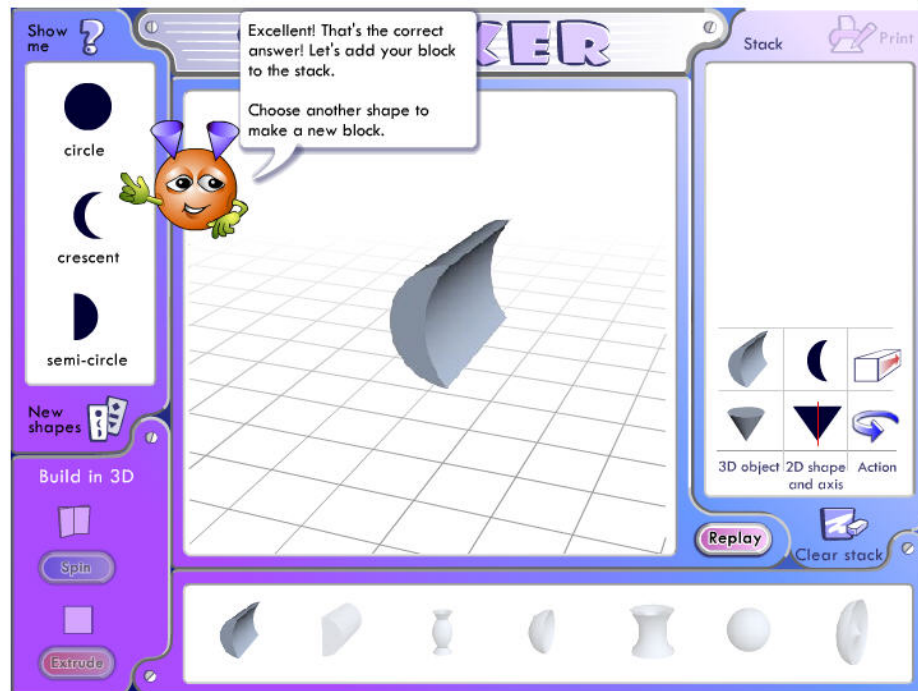
Students estimate the number and types of faces there are of various 2D shapes on a given complex 3D object. They then test this estimate by identifying and painting all the different 2D objects. These include hexagon, pentagon, rhombus, trapezium and some irregular shapes. The types and number of shapes correctly painted are recorded as they progress.

Face painter: predicting faces

Students are presented with various 2D shapes. They identify each type and predict the number of each of the 2D shapes that make up the complex 3D object on the upper screen. The shapes include equilateral and isosceles triangles.

Shape maker (Years 2–6)

This series enables students to explore the relationships between 2D shapes and 3D objects by visualising the movement (translation or rotation) of the 2D shape and predicting the resulting 3D object.



Learning objects	LO ID	Years
Shape maker: simple objects	1060	2–3
Shape maker: blocker	1058	3–4
Shape maker: stacker	588	3–4
Shape maker: replicator	1059	4–6
Shape maker: complex objects 1	1061	4–6
Shape maker: complex objects 2	1062	4–6

Shape maker: simple objects

Students select an object from a bank of simple 3D objects. They discover the method of re-creating this object by choosing from a bank of 2D shapes and then applying an action (spin or extrude) to it.

Shape maker: blocker

Students are required to visualise the result from spinning or extruding a simple 2D shape. They select a 2D shape and the action to be taken on it (spin or extrude). The final step requires them to choose the resulting 3D object. If the choice is correct, the transition from 2D to 3D is shown.

Shape maker: stacker

Students see the relationships between 2D shapes and 3D objects by visualising the movement of the 2D shape and predicting the resulting 3D object. Students build a stack of 3D objects by spinning or extruding 2D shapes. They select a 2D shape, and then choose whether to spin or extrude it. If they choose to spin it they also select an axis for spinning. The students visualise the 3D object it will become, and then check their prediction.

Shape maker: replicator

Students are required to break down an object made of several 3D objects into its components, and then duplicate these objects. They select a component, then the 2D shape they want and the action to be taken on it (spin or extrude) to match the chosen 3D object. The interaction ends when the given object has been replicated.

Shape maker: complex objects 1

The student selects from bank of complex 3D objects, and then discovers the method of re-creating this object by choosing from a bank of 2D shapes and applying an action (spin or extrude) to it.

Shape maker: complex objects 2

The student selects from a different bank of complex 3D objects, and then discovers the method of re-creating this object by choosing from a bank of 2D shapes and applying an action (spin or extrude) to it.

Building site (Years 4–9)

The Building site series explores the concepts of angles; buildings (structures); cubes; projection (mathematics); side elevation; technical drawing; transformations and visual perception.



Learning objects	LO ID	Years
Building site: level 1	849	4–9
Building site: level 2	1097	5–9
Building site: level 3	1098	5–9
Building site: level 4	1099	5–9
Building site 	654	4–9

Students consider the detail of a given building plan (a number of coloured cubes, some obscured from view) to construct the required view as seen from ground level. This presents an aspect of spatial development and thinking that teachers value but have difficulty in managing and assessing in the classroom.

Building site: level 1

Students are presented with a plan of a geometrical landscape consisting of coloured cubes constructed on a 4 x 4 grid. Their task is to produce the required front, back or side views as seen from ground level. Students look down (bird's eye view) on single-storey building plans and analyse how the can be seen by a person standing on the ground level. They then use cubes to build a ground-level view of the building plan (from the front, side or back). The emphasis is on developing students' skills in translating from bird's eye views (plan representations) to orthogonal (face-on) views.

Building site: level 2

Students are presented with a plan of a geometrical landscape consisting of coloured cubes constructed on a 4 x 4 grid. Students look down on some multi-storey buildings. They build a ground-level view of the building plans from a given perspective: front, side or back.

Building site: level 3

Students are presented with a plan of a geometrical landscape consisting of coloured cubes constructed on a 4 x 4 grid. Students create a 2D plan from a 3D multi-storey plan.

Building site: level 4

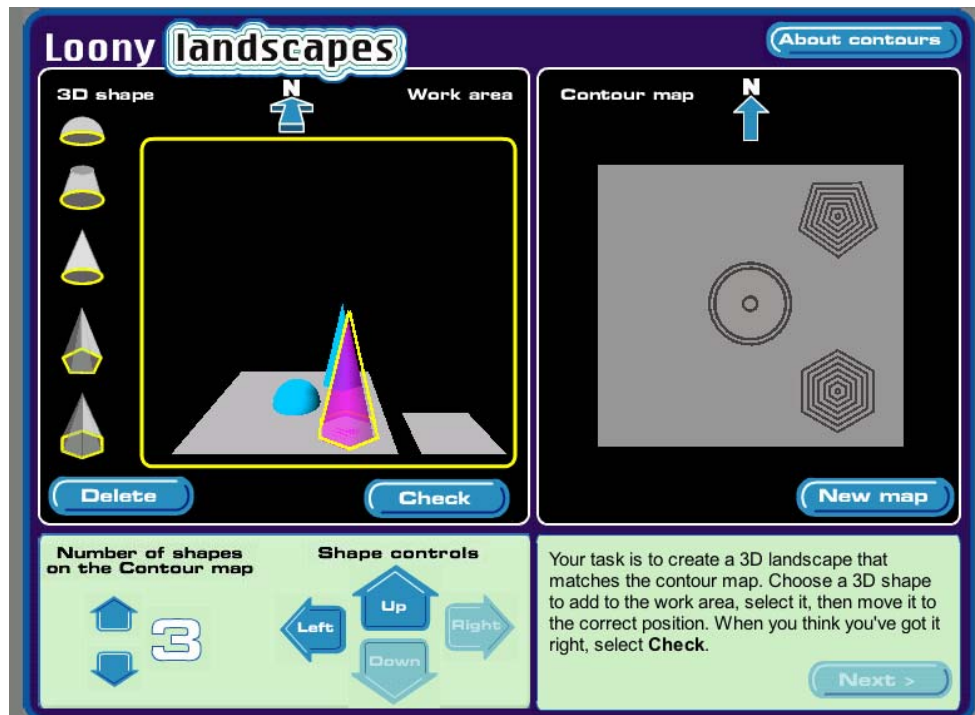
Students are presented with a plan of a geometrical landscape consisting of coloured cubes constructed on a 4 x 4 grid. Students build a 3D multi-storey plan from 2D plans.


Building site

This is an aggregated learning object combining the four other learning objects in a sequence.

Contours (Years 5–9)

The Contours series explores the concepts of angles; contour maps; geometric perspective; grids; prisms; shapes; symmetry; transformations; 2D and 3D environments and visual perception.



Learning objects	LO ID	Years
Contours: about contours	1329	5–9
Contours: mystery shapes	1096	5–9
Contours: loony landscapes	655	5–9
Contours 	1095	5–9

The activities introduce students to the idea of how contour lines represent a shape of artificial landforms, in this case geometrical solids. Students are shown how different shapes have different contour line patterns. They are presented with 'landforms' and contour representations in a matching task. In the more complex levels, students are presented with a contour map of a geometrical landscape and are required to construct the landscape to match the map.

Contours: about contours

'Contours: about contours' learning object can be used to introduce students the Contours series of learning objects, and can be used separately to provide an introduction to the concept of contour lines.

Contours: mystery shapes

Students are required to interpret a 3D landscape and create a contour map using predefined contour objects. They are presented with a random scene of contour outlines that have been mapped as 3D objects on a plane. Students select from a number of contours and decide where to place them into the scene that is consistent with the 3D landscape.

Contours: loony landscapes

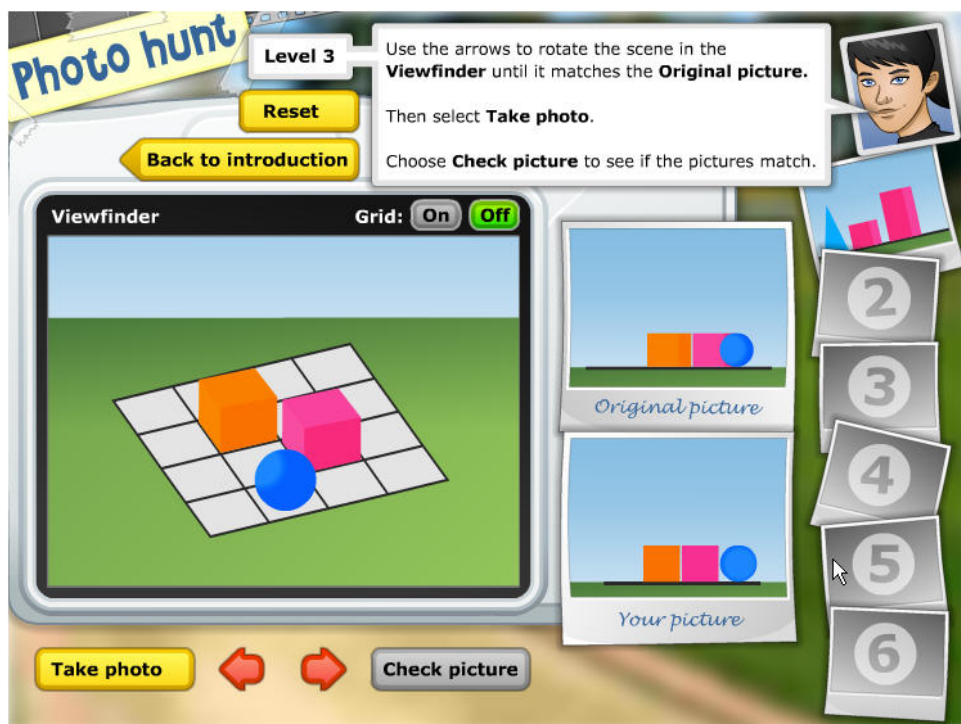
Students are required to interpret a contour map and create a landscape using predefined 3D objects. They are presented with a random scene of 3D objects that have been mapped as contour outlines on a plane. Students select from a number of objects and decide where to place them into the scene that is consistent with the contour map, using the 'reference picture' as a guide.


Contours

This is an aggregated learning object combining the three other learning objects.

Photo hunt (Years 4–9)

In the Photo hunt series, students visualise and match different perspectives of 2D representations of 3D solids such as cylinders, cones and cuboids.



Learning objects	LO ID	Years
Photo hunt: level 1[Flash player version]	6258	4–9
Photo hunt: level 2 [Flash player version]	6259	4–9
Photo hunt: level 3 [Flash player version]	6260	5–9
Photo hunt: level 4 [Flash player version]	6261	5–9
Photo hunt [Flash player version] 	6246	5–9

Activities in which students work with 3D spatial environments are often difficult for a classroom teacher to arrange.

In this series, students are presented with pictures of a range of different coloured 3D solid objects such as cylinders, cones and cuboids taken from different perspectives and they match each view to a 2D picture. To do this, they identify the relative positions of the objects by comparing the outlines and colours of the objects and by rotating a base grid until they find the view they think matches the original picture. They then take a photo of their picture and check if it does match the original one. Visual feedback is provided to the student. Each object has six tasks of increasing complexity.

Photo hunt: level 1

Students can rotate their picture in a horizontal plane only.

Photo hunt: level 2

Students can rotate their picture in either a horizontal or vertical plane.

Photo hunt: level 3

Students have an elevated view of the picture and can rotate their picture in a horizontal plane only.

Photo hunt: level 4

Students have an elevated view of the picture, can rotate their picture in a horizontal plane only and the objects displayed have only one or two colours.

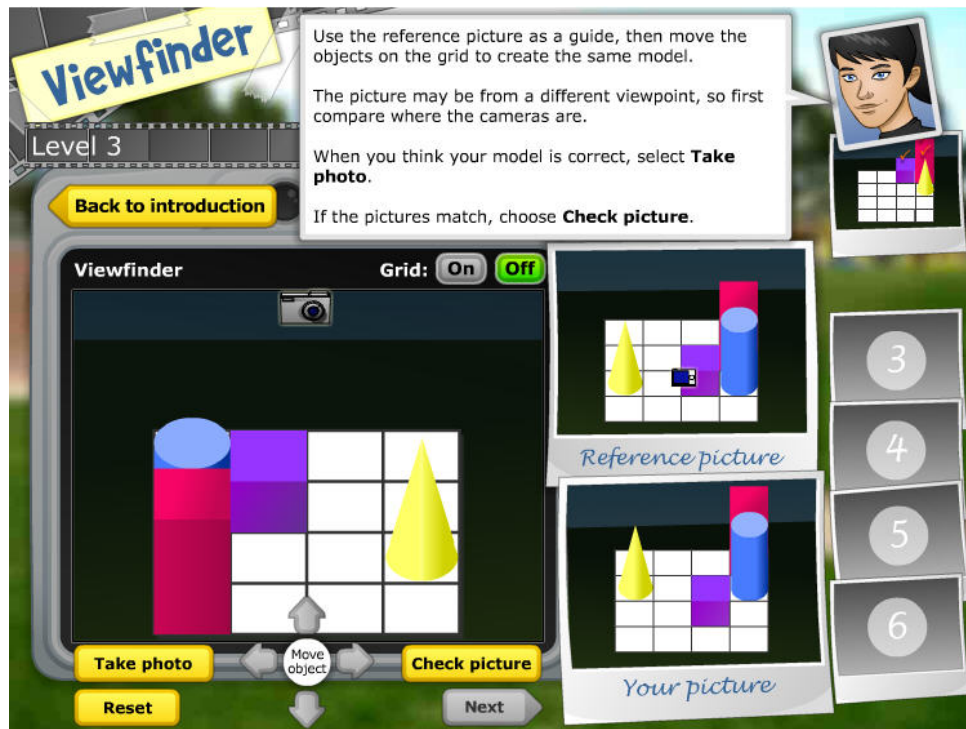
Photo hunt


This is an aggregated learning object combining all four levels of difficulty in a sequence.

Note: The Photo hunt [Flash Player version] series of learning objects replaces the original Shockwave versions, which are no longer available due to technical difficulties.

Viewfinder (Years 4–9)

In the Viewfinder series students interpret and visualise 2D representations of 3D solids such as cylinders, cones and cuboids from different perspectives.



Learning objects	LO ID	Years
Viewfinder: up front [Flash player version]	6265	4–9
Viewfinder: flip side [Flash player version]	6264	5–9
Viewfinder: backwards glance [Flash player version]	6263	5–9
Viewfinder: all angles [Flash player version]	6262	5–9
Viewfinder [Flash player version] 	6245	5–9

Activities in which students work with 3D spatial environments are often difficult for a classroom teacher to set up.

In the View finder series, students are shown a reference picture of solid objects on a grid taken from the front, side or back. Students then move the objects around the grid to try and match the reference picture perspective. They take a photo of their picture to check it against the reference picture. Visual feedback is provided. Each object has six tasks with four levels of difficulty.

View finder: up front

Students view both the reference picture and the base grid front-on.

View finder: flip side

The reference picture is taken from the side of the base grid.

View finder: backwards glance

The reference picture is taken from behind the base grid.

View finder: all angles

Three levels focus on a different aspect of spatial perception while one level is generated randomly.

Viewfinder

This is an aggregated learning object combining the other four learning objects.

Note: The Photo hunt [Flash Player version] series of learning objects replaces the original Shockwave versions which are no longer available due to technical difficulties.

Journey planner (Years 6–9)

In the Journey planner series, the student is required to make decisions about transport alternatives based on information presented in train and bus timetables. The student is presented with public transport challenges and is required to consider bus and train alternatives (sometimes combinations of the two) in order to reach destinations by the earliest possible time of arrival. The objects make demands on students' understanding of time and timetables, and assist them in developing skills in reading timetables, considering alternative modes of transport and alternative routes.

Journey planner
Quickest route 2

Introduction
Show instructions

You are ready to leave Henley at 4:00 pm. Choose the quickest way (train or bus) to get to Flynn. If you take the train, you need to change at Gaston.

4:25 pm

Logan Line
Midford Line
Stanton Bus
Henley Bus
Belle Bus

Your trip

Step	Details	Arrival time
1	Train - Henley to Ashford	4:05
2	Train - Ashford to Gaston	4:25

Total time 25 min

Check trip

Timetable - Midford line

Station	3:45	4:00	4:15
Midford			
Henley	4:00	4:15	4:30
Ashford	4:05	4:20	4:35
Gaston	4:10	4:25	4:40
Morgan	4:15	4:30	4:45
Redwater	4:20	4:35	4:50

Check all timetables for the best times.
Select a time to add it to your trip.

Learning objects	LO ID	Years
Journey planner: quickest route 1	764	6–9
Journey planner: quickest route 2	765	6–9
Journey planner: quickest route 3	1111	6–9
Journey planner: quickest route 4	1112	6–9

The learning objects in the series become progressively more difficult as the numbers of options and alternatives increase.

Journey planner: quickest route 1

Students compare the relative speeds over three different short routes between train and bus travel to select the quickest trip.

Journey planner: quickest route 2

Students compare the relative speeds over three different short routes between train and bus travel to select the quickest trip. The trips require changing trains at a particular node.

Journey planner: quickest route 3

Students select the quickest trip from three different routes. They can use a combination of train and bus travel.

Journey planner: quickest route 4

Students select the quickest trip from three different complex routes. They can use a combination of train and bus travel.

Content from other sources

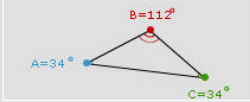
Exploring Space (Years 6–9)

These learning objects are short digital activities that allow students to explore and practise a range of concepts and operations relating to Space.

Exploring angles

Resize a triangle

Drag the handles on the vertices to change the dimensions of the triangle.



$$\angle A + \angle B + \angle C = 34^\circ + 112^\circ + 34^\circ = 180^\circ$$

[Start the activity](#)

Items in this group

[Resize a triangle](#)
[Video](#)

Acknowledgements

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Identifiers TLF LearningObject L6555
Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Description

Construct triangles of various sizes to explore the sum of all interior angles.

Instructions

First, move the circles on the three angles of the triangle to change the triangle's dimensions. Then experiment with these dimensions by enlarging the triangle to a maximum size, and by reducing it to a minimum size. Observe the changing values of the angles on the triangle, and their total sum in the equation at the bottom of the screen.

Learning objects	LO ID	Years
Exploring relationships of angles	6554	6–9
Exploring angles	6555	6–9
Exploring diameter and circumference	6556	6–9
Exploring quadrilaterals	6562	6–9
Exploring transformations	6565	6–9
Exploring dilations	6566	6–9

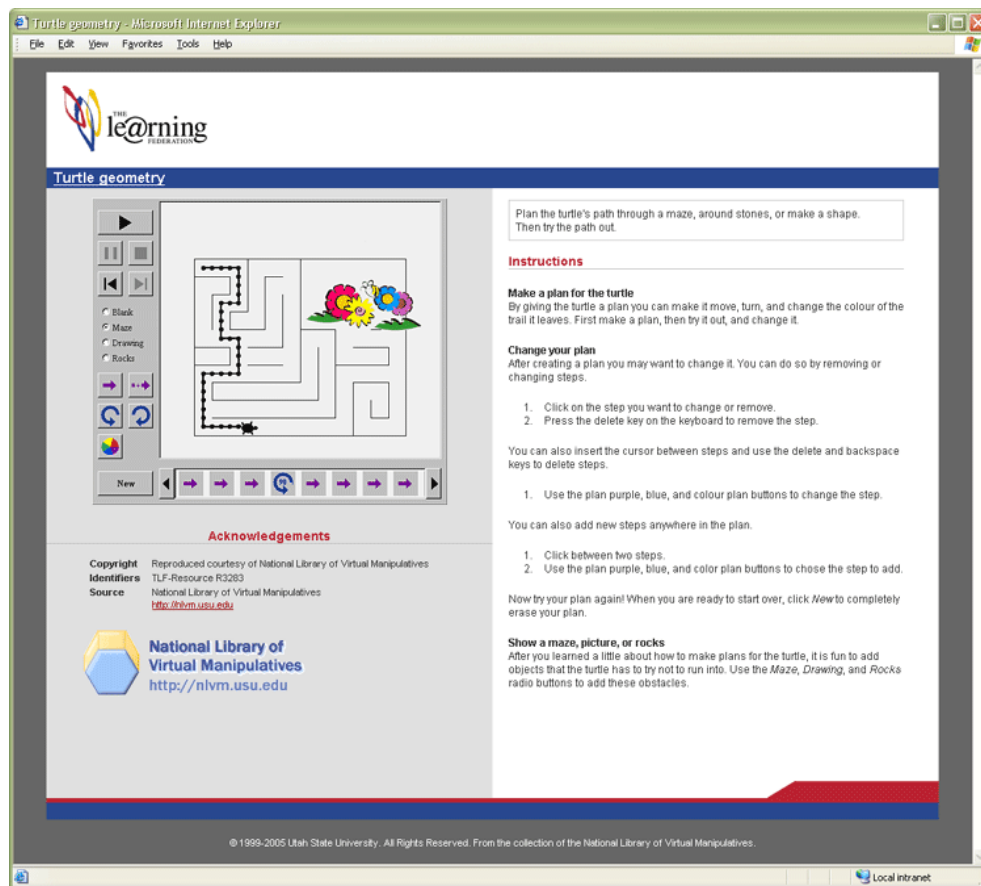
This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are presented in template format with a description and instructions. Each learning object often contains two or more separate activities or games. Some also come with a short video which provides everyday examples of the mathematical principles featured in the learning object.

These learning objects are licensed from Alberta Education, Canada (www.learnalberta.ca).

Space Manipulatives (Years P–9)

These learning objects are manipulatives that allow students to explore and practise a range of concepts and operations relating to space.



Learning objects	LO ID	Years
Attribute blocks	3511	P–3
Ladybird mazes	3535	P–4
Pentominoes	3540	P–9
Tessellations	3547	P–9
Pattern blocks	3539	2–6
Geoboard	3528	3–9
Geoboard: coordinate	3529	5–9
Geoboard: isometric	3530	5–9
Congruent triangles	3517	4–9
Platonic solids	3542	4–9
Polyominoes	3543	4–9
Turtle geometry	3505	6–9
Golden rectangle	3533	6–9

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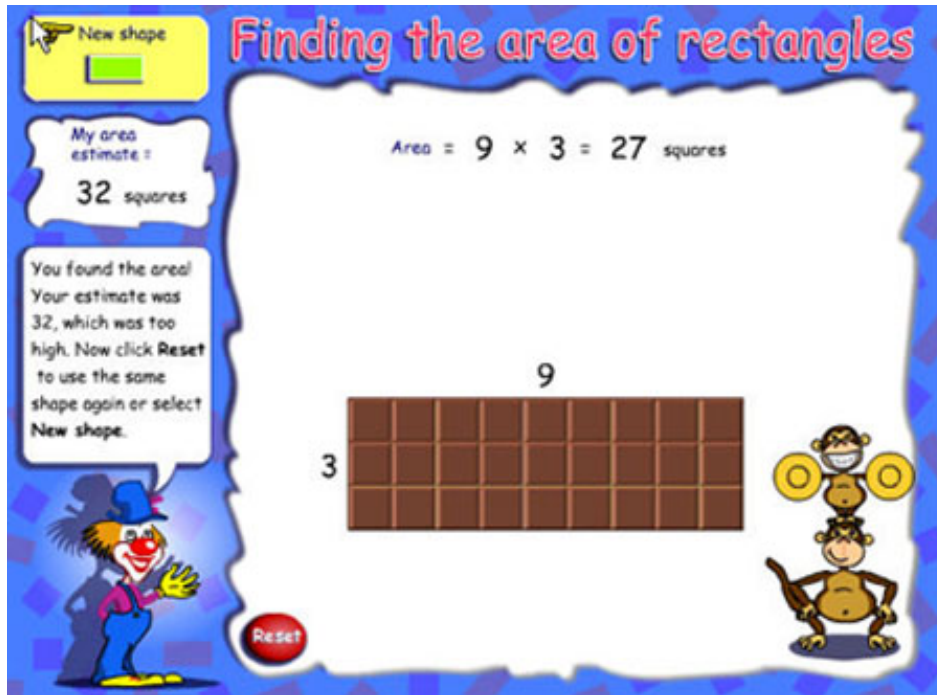
These learning objects are licensed from the National Library of Virtual Manipulatives, USA
(<http://nlvm.usu.edu>).

Measurement

The Measurement learning objects released to date have are grouped into the following series.

Area concept (Years P–4)

The Area concept series is designed to introduce students to the concept of area as covering a surface, and to introduce the formula for calculating the area of a rectangle.



Learning objects	LO ID	Years
Finding the area of rectangles	384	P–3
Finding the area of compound shapes	383	2–4
Area counting with Coco 🍌	139	2–4

Two levels of difficulty are provided: rectangles, and compound shapes made up of rectangles. These two levels are also available separately.

Finding the area of rectangles and Finding the area of compound shapes

The setting is a circus environment. Students are first asked to estimate the area of the shape using a reference square, and then cover the shape. Students first complete a row or a column and then are offered the opportunity to copy the entire row or column to complete the rectangle.

Once the shape is covered, students are asked to calculate the area, using the formula and asked to insert the dimensions. Scaffolding is quite extensive, with visual cues to reinforce the idea of length times width. An animated multiplication table provides help for students who experience difficulty with calculating the product.

Area Counting with Coco

This is an aggregated learning object combining the two other learning objects.

Area of triangles (Years 6–9)

Students often know how to calculate the area of a rectangle and sometimes think that this formula applies to all shapes. The Area of triangles series concentrates on the relationship between the area of a rectangle and the area of a triangle.

Now use the formula to find the area of the triangle.

Estimate 10 to < 20 sq cm

MAKE TRIANGLE

New triangle

Reset triangle

base

height

Replay

Work out the area of the triangle on the right.

Area = $\frac{1}{2} \times 4 \times 3 =$ [] sq cm

Submit

Learning objects	LO ID	Years
Area of triangles: triangles with a right angle	354	6–9
Area of triangles: height intersects with the base inside the triangle	355	6–9
Area of triangles: height intersects with the base outside the triangle	356	6–9
Area of triangles: triangles without vertical or horizontal sides	357	6–9
Area of triangles 🎨	145	6–9

'Area of triangles: Triangles with a right angle' presents triangles in which there is a horizontal or vertical edge. As for all learning objects in this series, the first step is to estimate the area by selecting a range. Students are then asked to select an edge for the base. While any edge can be selected, a hint appears on the screen: 'Horizontal and vertical sides are easier to use for the base'.

Once the base is determined, students are asked to identify the height. A line perpendicular to the base is provided and students are required to slide this line to the correct position, reinforcing the concept that the height is perpendicular to the base and intersects with the vertex opposite the base.

The next step is to draw a rectangle around the triangle. The triangle then clones, the second triangle is cut into appropriate pieces, and students are invited to place these pieces inside the rectangle so they see that the rectangle is twice the area of the triangle. Some formulas are presented and students are asked to select the appropriate formula for calculating the area of a triangle. Scaffolding reinforces the idea that the area of a triangle is calculated as half the base times the height. Students then calculate the area of the triangle, with a suggestion of using a calculator if necessary and an emphasis on the 'half' in the formula.

Variations include triangles in which there are no horizontal or vertical edges, cases where the height intersects with the base outside the triangle and the special case of right-angled

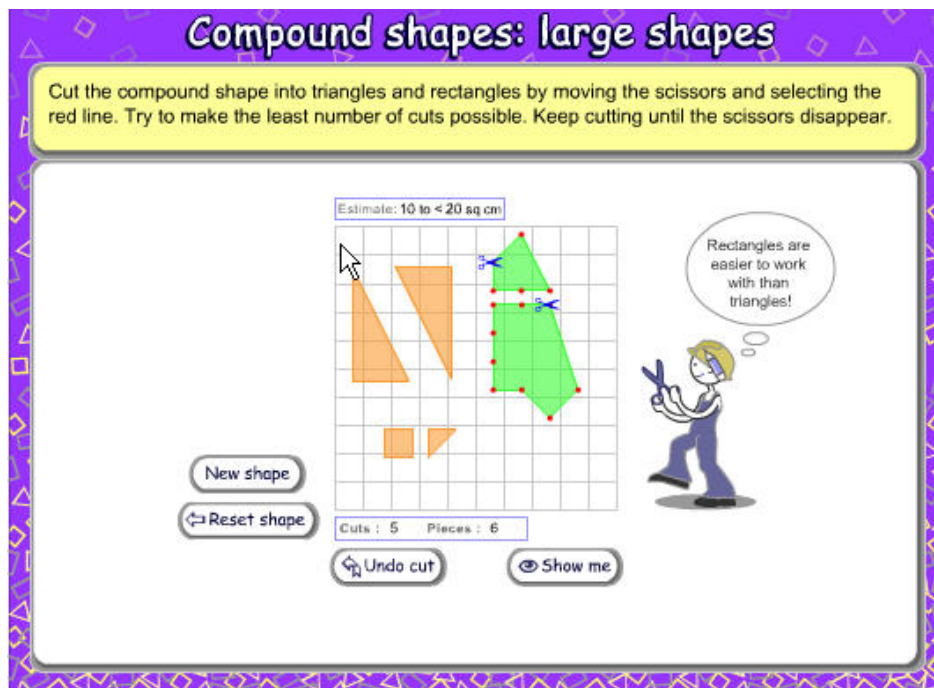
triangles. In some cases, when the dimensions are difficult to determine from the underlying grid, they are provided.

This series could be used to investigate the conservation of area regardless of which base and height pair is chosen.

'Area of triangles' is an aggregated learning object combining three of the four operations.

Area of compound shapes (Years 6–9)

Students use a tool to 'cut' compound shapes into triangles and rectangles and then select the appropriate formula to calculate the area of each piece and, finally, the area of the total compound shape.



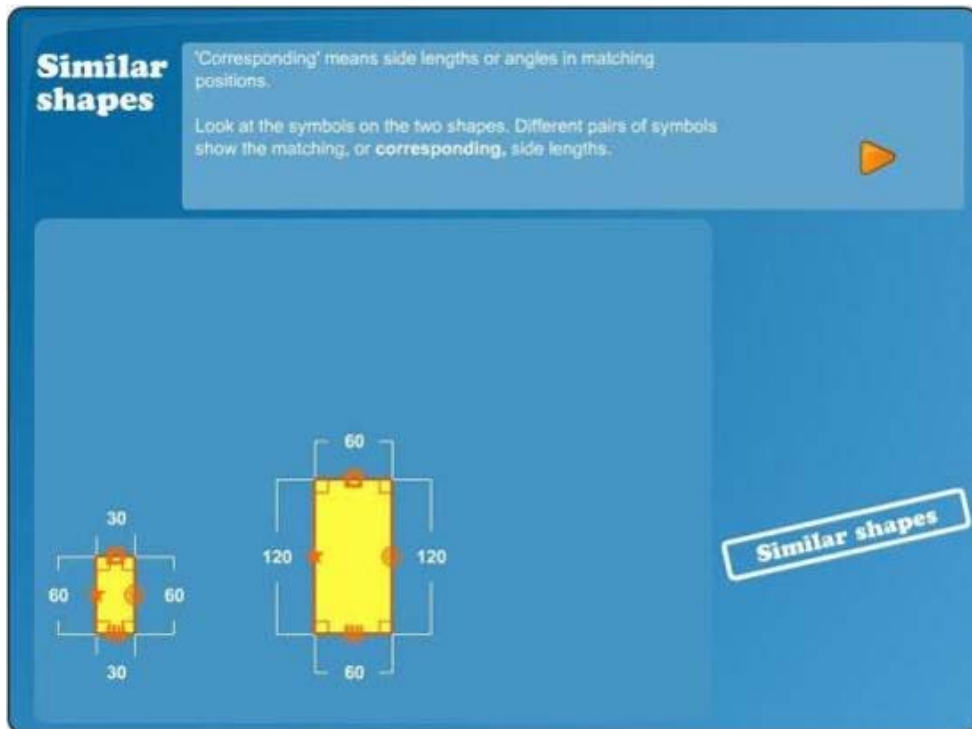
Learning objects	LO ID	Years
Compound shapes: small shapes	150	6–9
Compound shapes: medium-sized shapes	151	6–9
Compound shapes: large shapes	152	6–9
Compound shapes 🧩🧩🧩	153	6–9

Students are encouraged to be efficient in their 'cutting' so that their compound shape is cut into a small number of pieces. Shapes presented range in size and complexity.

'Compound shapes' is an aggregated learning object combining the three other learning objects in a sequence.

Measures (Years 7–9)

The Measures series focuses on investigating the spatial properties of similar plane shapes and solids.



Learning objects	LO ID	Years
Measures: similar shapes	2309	7–9
Measures: scaling up	2310	7–9
Measures: scaling down	2311	7–9
Measures: similar solids	2312	7–9
Measures: scaling up solids	2313	7–9
Measures: scaling down solids	2314	7–9
Measures: scaling surface area	2315	7–9
Measures: volumes	2316	7–9

The Measures series provides students the opportunity to distinguish between similar and non-similar shapes and objects and use ratio to quantify and describe the relationships between their measurable attributes (length, areas, volumes).

Student manipulation of figures on-screen allows exploration and recognition of similar and non-similar shapes, leading to a focus on recognising and using ratio in similar shapes to calculate unknown lengths and describe relationships between perimeters, areas, surface areas and volumes of similar shapes and solids.

Measures: similar shapes

Students are presented with pairs of similar shapes—one of the pairs is fixed, the other manipulable. Through manipulation of the shapes and using multiplication facts in ratio and scale situations, students understand that similar shapes are shapes that have the same angles and where the corresponding side-lengths are in proportion. The shapes used are rectangles, squares, right angle triangles, isosceles triangles and equilateral triangles. The

student is also presented with similar shapes in different orientations to make the task more challenging. Students receive a points score after ten attempts.

Measures: scaling up

Students scale up shapes to create similar plane shapes. Students are presented with simple shapes, asked to choose an enlargement scale factor and record their observations in a table. They must predict the area scales factor in the table before the larger shape is drawn. The shapes are rectangles, squares or triangles.

Measures: scaling down

'Measuring: scaling down' is the same as the scaling up learning objects except the student explores the relationships between side-length scale factor and area scale factor when reducing the size of a given shape.

Measures: similar solids

'Measuring: similar solids' is the same as 'Measuring: similar shapes' but uses solids, including cubes, triangular prisms, cylinders, cones and irregular shapes.

Measures: scaling up solids

Students scale up solids to create similar solids.

Measures: scaling down solids

Students scale down solids to create similar solids.

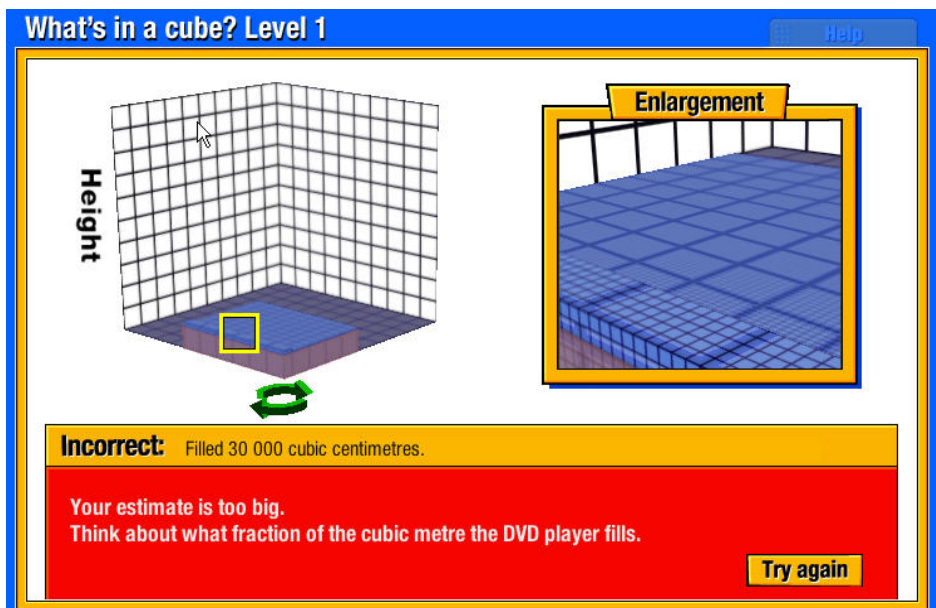
Measures: scaling surface area

Students identify the relationship between the side length scale factor and the surface area when scaling solids. They use this relationship to complete scaling tasks.

Measures: volume

Students identify and describe the relationship between side lengths and volume when scaling up prisms. Students used this relationship to complete tasks.

Inside cubes (Years 5–9)



Learning objects	LO ID	Years
How big is a cubic metre?	163	5–8
Inside a cubic metre	164	5–8
What's in a cube?: level 1	165	5–8
What's in a cube?: level 2	166	5–8
Working it out!	167	7–9

How big is a cubic metre?

Cary Cubemeister presents students with the challenge of estimating how many cubic centimetres are contained in a cubic metre. Students are challenged to provide an estimate and then are shown how their estimate fits within a transparent cubic metre. Feedback is visual and students are offered three opportunities before being given the chance to find out. The feedback animation of their estimate is shown by a series of cubes systematically filling up the cubic metre. An enlargement tool allows students to examine results in detail. A counter records the progress of the animation and the rotation tool enables the cubic metre to be viewed from different aspects.

Students are then asked to estimate the number of cubic centimetres in the length and width of the cubic metre. The concept of volume is further enhanced by students estimating the number of cubic centimetres in each layer of the cubic metre and the idea that the volume of a cuboid can be calculated by multiplying the area of the base by the height.

Inside a cubic metre

The 'Inside a cubic metre' learning object focuses on how many cubic centimetres there are in various fractions of a cubic metre. Students are asked to enter their estimates of the length and width, and then how many cubic centimetres are in parts of a cubic metre. Once they get the estimate correct, assisted by the animation and the counter, the decimal fraction value is displayed. There are several levels of difficulty, each culminating in the presentation of a table on which students are asked to complete blank cells, including the decimal fraction.

This learning object, while focusing on volume, would also be a useful means of discussing large numbers and decimal fractions.

What's in a cube? levels 1 and 2

In the first level of this learning object, students are presented with a variety of cuboid or cuboid-like objects inside a cubic metre grid and asked to estimate the volume of the objects. The strategy encouraged is to compare the object with the cubic metre – that is, 'I think the DVD player is about one-tenth of the cubic metre' – and to iteratively improve their estimate by watching the animation of their estimate. The rotation tool is available so students can view the object from a number of aspects. An enlargement tool allows close examination of the result of their estimate and of the object.

The iterative approach is enhanced by students being able to override the animation and enter an improved estimation.

The second learning object in this series involves estimating the volumes of objects that are less regular. Students are encouraged to imagine the object broken up into a number of cuboids to estimate the volume of each cuboid piece and then to add their estimates to get their answers. The animation, enlargement and rotation tools are available to help. In addition, if the first estimate is incorrect the object is broken up into the component cuboids, which are arranged to assist in the estimation.

Working it out!

In the 'Working it out!' learning object, students work out the volume of a number of real-life cuboid-shaped objects using the formula: $\text{volume} = \text{area of base} \times \text{height}$. The dimensions are given in centimetres. The student is led step by step through the calculation process, first working out the area of the base of the cuboid, and then the volume. Visual feedback is provided by unit cubes covering the base to show base area, and then filling the cuboid to demonstrate volume. At the end of the learning object the user is asked to complete a table. Included in this table is a column for working out the equivalence in cubic metres.

Trigonometry (Years 7–9)

The Trigonometry series focuses on how the angles and side length properties of similar right-angled triangles may be applied in measurement situations to calculate unknown side lengths and angles.



Learning objects	LO ID	Years
Trigonometry: measuring with triangles	2326	7–9
Trigonometry: similar triangles	2327	7–9
Trigonometry: cosine	2328	7–9
Trigonometry: sine	2329	7–9
Trigonometry: tangent	2330	7–9
Trigonometry: using sine	2332	7–9
Trigonometry: using cosine	2333	7–9
Trigonometry: using tangent	2331	7–9
Trigonometry: finding the hypotenuse	2334	7–9
Trigonometry: finding angles	2335	7–9

In this series, there is a progression from the informal ratio techniques used in ancient cultures to the more formal methods of right-angled triangle trigonometry. A step-by-step approach with scaffolding and informative feedback leads students through establishing similarity, identifying corresponding sides, establishing equivalent ratios and finding unknown lengths. The learning objects in the series also introduce students to the formal trigonometric ratios sine, cosine and tangent and their use in triangle measurement contexts. The intent of this series of learning objects is to demonstrate and maintain the fundamental underpinning links between similarity and triangle trigonometry.

Trigonometry: measuring with triangles

Students see how the early Greeks and Egyptians used the properties of similar right-angle triangles to solve measurement problems. They then identify and record the relevant ratios in two similar right-angle triangles to find the unknown height of one of them (represented as the height of a column). This task is repeated twice more with increasingly complex ratios. The next demonstration focuses on the properties of similar isosceles right-angle triangles. Students then use ratio in three pairs of similar isosceles right-angle triangles to find the unknown value on one triangle

Trigonometry: similar triangles

Students manipulate and identify the properties of similar right-angle triangles.

Trigonometry: cosine

Students use a 'unit circle' tool to complete a table of values concerning cosine.

Trigonometry: sine

Students use a 'unit circle' tool to complete a table of values concerning sine.

Trigonometry: tangent

Students use a 'unit circle' tool to complete a table of values concerning tan.

Trigonometry: using sine

Students use sine and the properties of the right-angle triangles to solve measurement problems.

Trigonometry: using cosine

Students use cosine and the properties of the right-angle triangles to solve measurement problems.

Trigonometry: using tangent

Students use tan and the properties of the right-angle triangles to solve measurement problems.

Trigonometry: finding the hypotenuse

Students use sine to find the hypotenuse.

Trigonometry: finding the angles

Students use tri ratios to find missing angles.

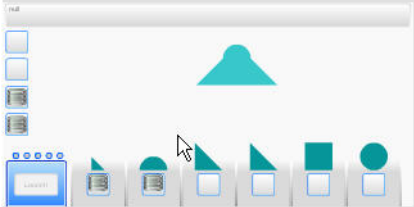
Content from other sources

Exploring Measurement (Years 6–10)

These learning objects are short digital activities that allow students to explore and practise a range of concepts and operations relating to Measurement.

Exploring area and perimeter

Combine shapes



[Start the activity](#)

Items in this group

[Create composite shapes](#)
[Combine shapes](#)
[Resize shapes](#)
[Video](#)

Acknowledgements

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Identifiers TLF LearningObject L6557
Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Description

Investigate operations and formulas to determine the total area of composite figures.

Instructions

There are six stages to work through for this activity.

1) The first task is to identify the different parts of the composite shape.

First, study the composite shape in the empty space closely. Then, identify which shapes it is composed of from the bottom row of different component shapes. To identify its different shapes, move one of the springs on the left side of the screen to the empty box under the corresponding shape at the bottom of the screen. Continue to move the rest of the springs one by one to the empty boxes under their corresponding shapes. To check if you are right, select **Launch**.

2) The second task uses the same shape, but this time you have to determine how the total area of the composite shape is calculated.

First, move the springs to the empty boxes underneath the addition and subtraction signs to choose whether the highlighted shapes at the top of the screen should be subtracted or added. Then, select **Launch** to see if you are right. Use the measurement diagram near the top left of the screen to help you.

3) The third task uses the same shape to determine which formulas can be used to calculate the areas of the component shapes.

Learning objects	LO ID	Years
Exploring ratios and proportions	6546	6–9
Exploring area and perimeter	6557	6–9
Exploring triangles	6558	6–9
Exploring square roots	6547	7–9
Exploring the Pythagorean theorem	6559	7–9
Exploring trigonometry	6561	8–10

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are presented in template format with a description and instructions. Each learning object often contains two or more separate activities or games. Some also come with a short video which provides everyday examples of the mathematical principles featured in the learning object.

These learning objects are licensed from Alberta Education, Canada (www.learnalberta.ca).

Time manipulatives (Years P–10)

These learning objects are manipulatives that allow students to explore and practise a range of concepts and operations relating to the measurement of time.



Time: analogue and digital clocks

Explore time using an analogue (or face) clock and a digital clock showing the same time, including seconds.

Instructions

Link Clocks

With the *Link Clocks* option checked (turned on), you can set the time on either clock, and the other will match it.

To change the time on the Face Clock:

1. Click on any of the hands; hour, minute, or second (if the *Show seconds* option is on), and drag it to show any desired time.
2. When the Face Clock time changes, the Digital Clock will immediately show the same time.

To change the time on the Digital Clock:

1. Click on the up (later) and down (earlier) arrow buttons for hours, minutes or seconds.
2. The corresponding hand on the Face Clock moves to keep the clocks showing the same time.

Learning objects	LO ID	Years
Time: analog and digital clocks	3548	P–6
Time: match clocks	3549	P–6
Time: what time will it be?	3550	P–6

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are each presented in template format with a description and instructions.

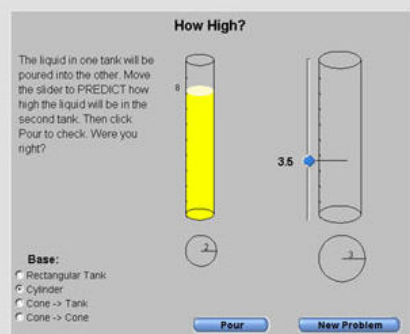
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Volume manipulative (Years 4–9)

This learning object is a manipulative that helps students understand the concept of conservation of volume.



How high?



Learn about conservation of volume by pouring an amount of liquid between rectangular, cylindrical or conical containers.

Instructions

1. Choose the shape of container to use by clicking on one of the *Base* options. The container on the left will be partially filled with a liquid.

How high will liquid go when it is poured from the container on the left to the one on the right?

2. Click and drag the arrow next to the container on the right to the level you think the liquid will reach when it is poured from the container on the left.
3. Click on *Pour*. The liquid will be poured. Compare the height of the liquid to your guess to see how close you were.
4. Click on *New Problem* to start a new problem.

Acknowledgements

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Identifiers TLF LO ID - 3534

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Learning objects	LO ID	Years
How high?	3534	4–9

This learning object contains non-TLF content. See Acknowledgements in the learning objects.

This manipulative is presented in template format with a description and instructions.

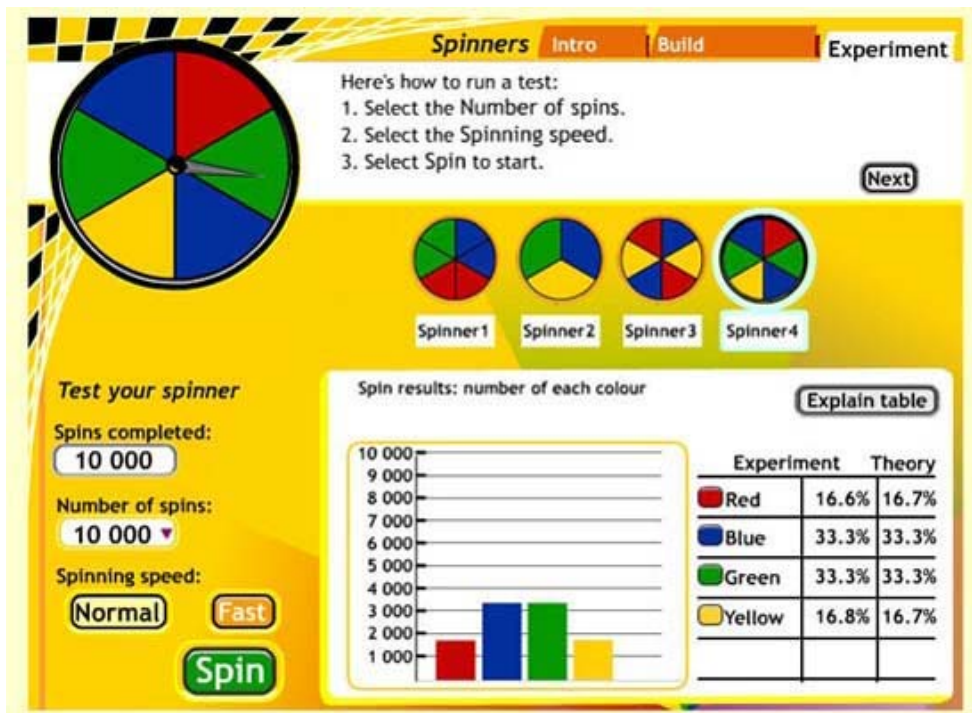
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Chance and data: chance focus

The Chance and data: chance focus learning objects released to date have are grouped into the following series.

Spinners (Years P–6)

The Spinners series provides students with opportunities to explore basic concepts, language and reasoning relating to chance and data.



Learning objects	LO ID	Years
Spinners: basic builder	2376	3–4
Spinners: advanced builder	2377	3–6
Spinners: predict and test	2378	P–1
Spinners: spin and label	2379	1–2
Spinners: explore	2380	2–3
Spinners: match up	2381	4–5

Students construct spinners to investigate and test the relationship between the structure of a random generator (sample space) and the likelihood of individual outcomes or results from a series of outcomes. The rapid generation of data in dynamic tables and graphs allows an introduction to the notion of long-run data being more reliable than short-run data.

Spinners: basic builder

The student uses the spinner-making tool to build their own spinners. They choose a colour for each part of the spinner, choose how many times to spin and then investigate what colour the pointer lands on each time. The student observes a graph being built and the numbers in the table changing each time the pointer stops on a colour.

Spinners: advanced builder

The student uses the spinner-making tool to build their own spinners. They choose a colour for each part of the spinner, choose how many times to spin and then investigate what

colour the pointer lands on each time. The student observes a graph being built and the numbers in the table changing each time the pointer stops on a colour.

In this more complex version of 'Spinners: basic builder' there are more parts on the spinner and more colours allowed.

Spinners: predict and test

Sectors on the spinner represent two different cars that are racing along a track of 10 spaces, with each spin determining which car moves forward one space towards the finish line. The student assesses the likelihood of each car winning the race when using a spinner of equal or biased nature to determine which car moves further.

Mathematical focus is on awareness of equal and unequal likelihood and also on beginning to explore the relationship between sample space and likelihood of outcomes. Data emphasis is on result of each spin.

Spinners: spin and label

The student chooses one of three spinners in response to a likelihood statement, then 'tests' the spinner with 10 spins.

The student repeats the process with the other two spinners. The task concludes with student selecting likelihood statements to match with each spinner.

Mathematical focus is on experiencing the collection of frequency data (result of each spin) and relating this to the sample space (spinner). The link between sample space and likelihood of outcomes (equally likely, less likely, more likely) is also included. Data emphasis is on the result of each spin. Descriptive language is used to express relationships and likelihood.

Spinners: explore

The student starts with an equal spinner of three different colours. Before starting a trial the student must observe the sample space of the spinner and make a prediction as to the most likely outcomes of the result of the trial. The student then runs a trial of 1000 spins only. A dynamic graph changes to reflect outcomes of the trials. A miniature of the spinner and graph are retained as a record.

The student alters sizes of sectors and initiates another series of trials, with results shown on a graph. A miniature of the spinner and graph is retained as a record. This is repeated with a third spinner.

The student is presented with six labels to consider, then matches the most appropriate label to each of the three spinners, eg 'Same chance for each colour', 'Red will spin more often than other colours', 'Less chance for yellow'.

Mathematical focus is on awareness of equal likelihood, less likely, more likely, and exploring the relationship between sample space and likelihood of outcomes. Data emphasis is on the result of each spin and introduces the notion of long run data being more informative about likelihood.

Spinners: match up

The student is presented with four spinners containing two or three different colours—some contiguous and others non-contiguous – and asked to predict which two they think would be likely to produce the similar results from a set of spins.

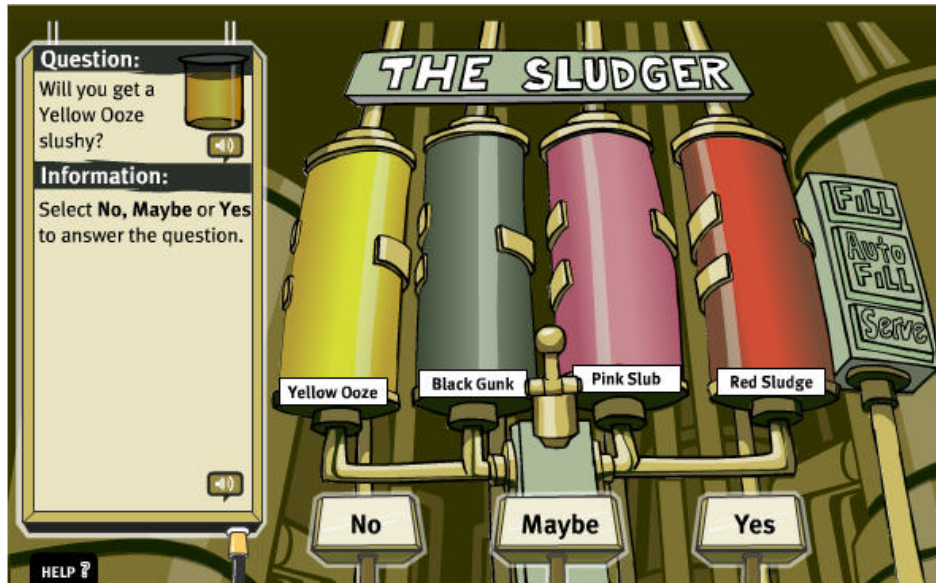
The student selects the number of spins to be conducted (10, 100, 10,000) and initiates the trials for both spinners. A set of simultaneous dynamic graphs build. The student has the option to increase number of trials.

The student indicates whether they think the data confirms or contradicts their prediction of 'sameness'. Feedback will include animation showing the joining together of split sectors. The opportunity to choose and test other spinners will be given.

Mathematical focus is on the equivalence of sample spaces that are visually different (contiguous and non-contiguous, ie blocks of colour vs split sectors). Data emphasis is on the result of each spin. The notion of long run data being more informative about likelihood is incorporated.

The sludger (Years 2–4)

The sludger series is the least complex in the Chance and data: chance focus strand. Students are presented with the sludger that randomly delivers different flavoured slushies such as Pink slub, Blue goo or Yellow ooze.



Learning objects	LO ID	Years
The slushy sludger: questions	115	2–4
The slushy sludger: best guess	116	2–4
The slushy sludger: go figure	117	2–4

The slushy sludger: questions

In 'The slushy sludger: questions' the Auto fill mode is operating. Students select yes, no or maybe to best describe the mathematical chance of the sludger serving a particular flavour. Students then select the serve button to see if their prediction is correct. Feedback provides information about the mathematical thinking but emphasises the concept that with random devices the outcome can be something other than the mathematical likelihood. For instance, when the sludger presents students with three of the four flavours that are the same, it can still serve the least likely.

In the second sequence of activities students are asked to 'fill' the sludger to conform to a particular statement of probability. For instance, 'Will you get Green slime? Select the flavours so that the answer is yes'. As in the previous sequence, the effect of randomness and its possible conflict with the understanding of mathematical probability is highlighted. Students can choose to return to the auto fill mode at anytime once the fill mode is activated.

Slushy sludger: best guess

'Slushy sludger: best guess' is designed to allow users to explore the idea of probability. The user is asked to 'select the most common colour' and then see what happens when the sludger serves a slushy. The idea is that the most common colour is also the most likely slushy to be served but the random nature of the machine may result in an unlikely event occurring. As this learning object is targeted at young children whose reading skills are unlikely to be highly developed, minimal textual feedback is provided.

The slushy sludger: go figure

'The slushy sludger: go figure' learning object is amenable to a screen reader and could be used for whole-class or small-group discussion led by the teacher.

The vile vendor (Years 4–6)

A drink-vending machine dispensing all sorts of weird and wonderful cans of Revolting radish, Warm worm, Rusty nail and the like is the setting of this series of learning objects.



Learning objects	LO ID	Years
The vile vendor: questions	118	4–6
The vile vendor: go figure	211	4–6
The vile vendor: best guess	168	4–6
The vile vendor 🎲	226	4–6

The 'The vile vendor: questions' learning object asks students to select a word from a bank of five – impossible, unlikely, equal, likely and certain – to describe the chance of the vile vendor serving a particular drink. Feedback is provided for both correct and incorrect responses to reinforce students' understanding of the language and the concept of randomness. After a series of this type of question, students are offered the opportunity to fill the vendor: 'Select the drinks so that it is unlikely you will get a Cabbage drink.' In this mode, as in the previous one, the idea of chance resulting in an outcome different to that of the theoretical probability is explored.

'The vile vendor: go figure' learning object is amenable to a screen reader. It would be a useful tool for teachers to use to discuss probability and its associated language.

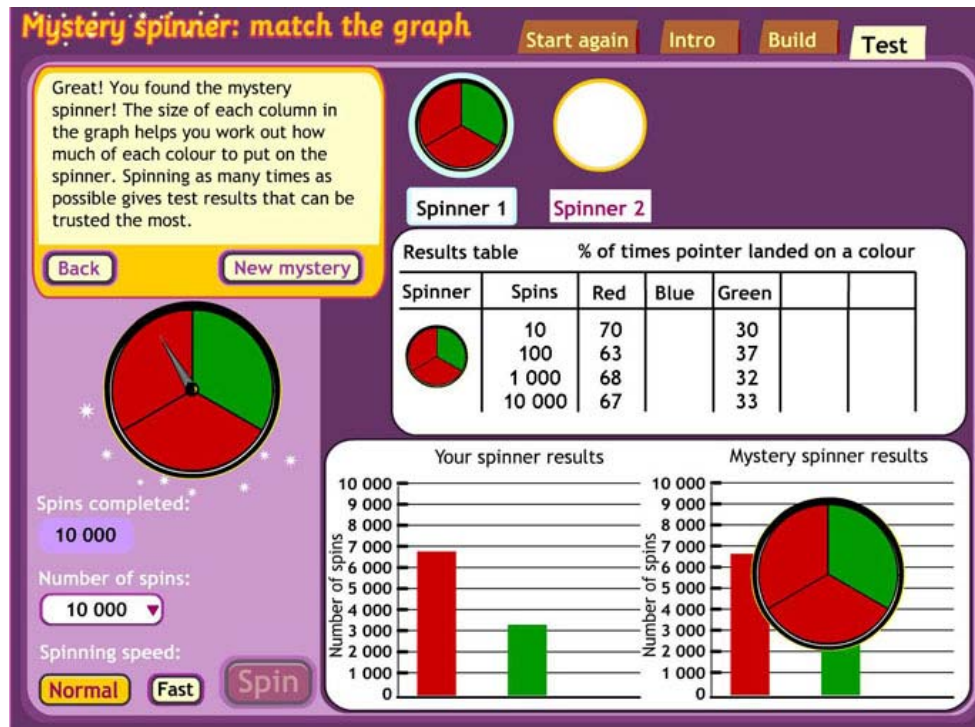
'The vile vendor: best guess' is designed to allow users to explore the idea of probability. The user is asked to select the most common drink and then see what happens when the vendor serves a drink. The idea is that the most common drink is also the most likely drink to be served but the random nature of the machine may result in an unlikely event occurring. Feedback supports the idea that understanding mathematical probability can enhance your chances of choosing correctly but that unlikely events can still occur.

'The vile vendor' is an aggregated learning object combining the three other learning objects.

Mystery spinner (Years 5–6)

The Mystery spinner series enables students to explore the relationship between sample space and likelihood of outcomes, using area-based random generators in the form of spinners. The rapid generation of data in dynamic tables and graphs introduces students to the notion of long-run data being more reliable than short-run data.

The Mystery spinner series complements and extends the Spinner series of learning objects.



Learning objects	LO ID	Years
Mystery spinner: challenge	2384	5–6
Mystery spinner: match the graph	2383	5–6
Mystery spinner	2382	5–6

Students are presented with a frequency graph, compiled following the testing of an unseen 'mystery' spinner. They work out the likely number of sectors and proportions of colours in the mystery spinner and create a spinner they think matches it. Students test their spinner and compare it to the graph generated by the mystery spinner.

Mystery spinner: match the graph

Students construct a spinner with up to three equal-sized sectors and fill the sectors with up to three colours to match the frequency graph.

Mystery spinner: challenge

Students create a spinner with up to five equal-sized sectors and fill the sectors with up to five colours to match the frequency graph.

Mystery spinner

This is an aggregated learning object combining the two other learning objects.

The foul food maker (Years 5–7)

In The foul food maker series, students are presented with a food maker that makes disgusting-sounding food. Will you get a slimy sandwich or slimy sushi or even a bug burger?

Question:
What is the chance you will get a Sock Soup?

Information:
Well done!
There is an equal chance that you will get a Sock Soup meal.
Select the Table/Graph button to see the probabilities.

Theoretical Probability PRINT

Look at the probability results in the table, and then type the missing numbers into the boxes to complete the table.

Meal	Fraction	Decimal	Percentage
1. Sock Soup	$\frac{2}{4}$	0.5	50%
2. Bug Burger	$\frac{1}{4}$	0.25	25%
3. Fly Soup	$\frac{1}{4}$	0.25	25%

Experiment Close

Learning objects	LO ID	Years
The foul food maker: questions 1	212	5–7
The foul food maker: questions 2	213	5–7
The foul food maker: best guess	214	5–7
The foul food maker: go figure	215	5–7
The foul food maker 🧩	227	5–7

In the questions subseries, students are first presented with the food maker and four different foods shown as possible outcomes. They select a word from a bank of five – impossible, unlikely, equal, likely and certain – to describe the chance of the food maker serving a particular food. Students select 'make' to see what is served. Selecting table/graph displays the theoretical probability in the form of a common fraction, a decimal fraction and a percentage. Students can choose to see what happens when 100 meals are served. This is displayed as a graph contrasting the theoretical result with the experimental result.

When students select table/graph in 'The foul food maker: questions 2', they are asked to enter numbers into blank spaces in the table. This demonstrates their understanding of equivalence between common fractions, decimal fractions and percentages.

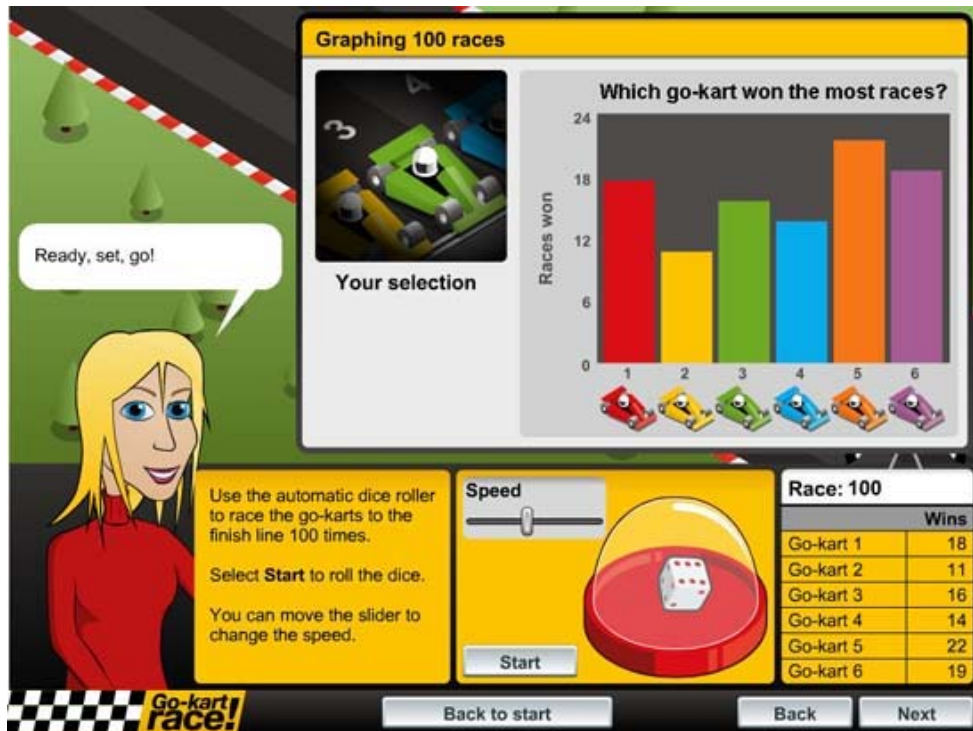
'The foul food maker: best guess' learning object asks students to predict which food will be served. Feedback reinforces the language used in the questions subseries. Teachers may find this a useful precursor to the questions subseries. The learning object has a Show results section that provides information on the number of correct predictions. This reinforces the idea that a knowledge of theoretical probability will help with predictions but, with a random generator, chance will sometimes give an unexpected result.


'The foul food maker: go figure' learning object of this series is amenable to a screen reader, enhancing accessibility for visually impaired students. This learning object could also be used as the basis of a whole-class or group discussion about theoretical probability and its associated language.

'The foul food maker' is an aggregated learning object combining the four other learning objects.

Dice duels (Years 6–9)

The Dice duels series comprises a range of dice-based tutorials, activities and games that enable students to explore even and uneven distribution and bias using dynamic, interactive tools.



Learning objects	LO ID	Years
Dice duels: go-kart race	2634	6–9
Dice duels: fair or unfair?	2635	6–9
Dice duels: uneven distribution	2636	6–9
Dice duels: bike race	2637	6–9
Dice duels: lucky 16 game	2639	6–9
Dice duels: airport addition	2323	6–9
Dice duels: airport subtraction	2640	6–9
Dice duels 	2641	6–9
Dice duels: load one dice	3671	6–9
Dice duels: load a pair of dice	3672	6–9
Dice duels: find the bias	3673	6–9
Dice duels: tool	2645	6–9

Dice duels: go-kart race

Students select a go-kart and observe how it performs in a race where the go-kart's progress is determined by the roll of a dice. They look for any patterns in the results of 100 races, increase the distance of the races and then observe the distribution of winners. Students consider how many rolls of the dice are required to get a winner of an individual race.

Dice duels: fair or unfair?

Students predict the result for 12 tosses of a fair dice. They observe what happens and record what they think about their prediction and the observed outcome.

Students increase the number of tosses up to 9999 and observe the graph of the results. Students consider the following: Are these results reassuring that the die is fair? How would you know if the die is not 'fair'? Should such variation in the distribution of outcomes be expected in what is referred to as an even distribution? If the die is loaded, what would repeated runs of 9999 tosses show?

Dice duels: uneven distribution

Students predict the result for 11 tosses of a pair of fair dice and observe what happens. They record what they think about their prediction and the observed outcome.

Students increase the number of tosses up to 9999 and observe the graph of the results. They then consider the following: Are these results reassuring that the dice are fair? How would you know if the dice are not 'fair'? Should such variation in the distribution of outcomes be expected in such an experiment? If the dice are loaded what would repeated runs of 9999 tosses show?

Dice duels: bike race

Students select a bike and observe how it performs in a race where the bike's progress is determined by the roll of two dice. They look for any patterns in the results of different bikes and in the results of 100 races. Students increase the length of the races and observe the distribution of winners. They consider how many rolls of the dice are required to get a winner of an individual race and consider if there any patterns emerging.

Dice duels: lucky 16 game

Students choose where to place 16 counters on a grid of numbers 2 to 12. Two dice are rolled and the sum calculated. One of the 16 counters is removed. The goal is to find a strategy to minimise the number of rolls required to remove all 16 counters from the grid. Students apply known underpinning mathematical theory or learn from experience. Either way there are variations from what might be expected.

Dice duels: airport addition

Students choose which airport runway for your plane to queue in while waiting to take off. At Pot Luck airport the runways are numbered 2 to 12 and the order of take-off is determined by the toss of two dice and adding the faces. The task is to choose a runway that improves your chance of a prompt take-off. Knowledge of the underpinning theory relating to uneven distributions (included as a tutorial option) helps, but sometimes there are unexpected delays.

Dice duels: airport subtraction

Students choose which airport runway for a plane to queue in while waiting to take off. At Pot Luck airport the runways are numbered 0 to 5 and the order of take-off is determined by the toss of two dice and taking the difference between the faces. The task is to choose a runway that improves the chance of a prompt take-off. Knowledge of the underpinning theory relating to uneven distributions (included as a tutorial option) helps, but sometimes there are unexpected delays.

Dice duels: load one dice

'Dice duels: load one dice' provides a tool for loading one face of a single dice. Students carry out one or more of the suggested investigations or test their own conjectures and theories. The 'What's the theory' option assists with the underpinning mathematical ideas.

Dice duels: load a pair of dice

'Dice duels: load a pair of dice' provides a tool for loading one or two faces (the same number or different numbers) of two dice. Carry out one or more of the suggested investigations or test your own conjectures and theories. The 'What's the theory' option assists with the underpinning mathematical ideas.

Dice duels: find the bias

Students use dice to explore relationships between bias, proportions, sample size, random variation and statistical distributions.

Dice duels

This is an aggregated learning unit combining 'Dice duels: load one dice', 'Dice duels: load a pair of dice' and 'Dice duels: find the bias'.

Random or not (Years 6–9)

The Random or not series provides a range of opportunities and interactive tools for students to learn about random events, and the patterns and variations occurring in such events. The context is a jube machine that randomly packages jubes of different shape and colour. The jubes in the machine make up a sample space based on an even distribution of 1:1 or 1:1:1 or an uneven distribution of 2:1. The focus throughout the series is the notion of long-run data being more reliable than short-run data due to random variation.



Learning objects	LO ID	Years
Random or not: explore numbers of jubes (1:1:1)	2392	6–9
Random or not: explore numbers of jubes (1:1)	3653	6–9
Random or not: explore numbers of jubes (2:1)	3654	6–9
Random or not: explore runs of jubes (1:1:1)	3658	6–9
Random or not: explore runs of jubes (1:1)	3659	6–9
Random or not: explore runs of jubes (2:1)	3660	6–9
Random or not: explore alternating jubes (2:1)	3661	6–9
Random or not: explore alternating jubes (1:1)	3662	6–9
Random or not: analyse numbers of jubes (1:1:1)	3655	6–9
Random or not: analyse numbers of jubes (1:1)	3656	6–9
Random or not: analyse numbers of jubes (2:1)	3657	6–9
Random or not: analyse runs of jubes (1:1:1)	3663	6–9
Random or not: analyse runs of jubes (1:1)	3664	6–9
Random or not: analyse runs of jubes (2:1)	3665	6–9
Random or not: analyse alternating jubes (2:1)	3666	6–9
Random or not: analyse alternating jubes (1:1)	3667	6–9

Random or not: open investigations	3668	6–9
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Random or not: explore and Random or not: analyse

At the Fantastic Fruit Jube factory, a machine packages jubes in random order into packets, each holding 12 jubes. The jubes are dispensed from a container holding different types of jubes in different proportions (depending on the learning object).

Two approaches underpin the learning objects in the series.

- In the **explore** subseries of learning objects students make a packet of jubes for the comparison of results against five machine-made packets and explore the variation in jubes from packet to packet.
- In the **analyse** subseries of learning objects the machine randomly generates all packets for the comparison of data. Students observe that the jubes vary from packet to packet and notice the patterns in successive batches (samples) of 1000 packets.

In both the explore and analyse subseries, the various learning objects allow students to investigate:

- the most commonly occurring type of jube (numbers of jubes)
- the longest run or sequence of jube (runs of jubes)
- the length of the longest alternating sequence of jubes (alternating jubes).

In addition, both the explore and analyse subseries allow students to investigate different outcomes when the sample space contains different ratios of jube types, including 1:1; 1:1:1; and 2:1.

Each of the 17 Random or not learning objects automatically collates experimental results and displays them as frequency graphs.

Random or not: open investigations

This is an open-ended exploratory tool for teacher and student use. Students can explore relationships between ratios, sample size, uneven distributions and random variation.

Content from other sources

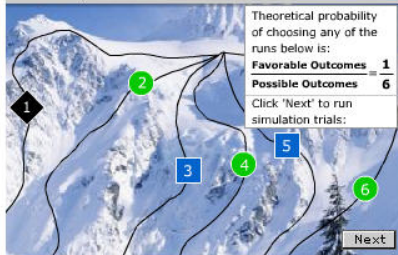
Exploring probability (Years 6–9)

This learning object allows students to compare theoretical and experimental probabilities in a snowboarding context.

Exploring probability

Examine trial results

A snowboarder has a choice of 6 different runs at the top of the ski hill.



[Start the activity](#)

Acknowledgements

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Identifiers TLF LearningObject L6567
Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Description

Compare theoretical and experimental probabilities by exploring a snowboarder's choice of six different runs.

Instructions

Which one of six runs down a hill will a snowboarder make? Run probability trials to find out.

Select **Next** to run the trials and start the activity. Select **10**, **100** or **10 000 Trials** from the row of trials at the bottom of the graph to see their probability outcomes. Select each **Trial** several times and compare the results. Move over each bar graph to see each run's probability result in fractions and percentages.

Select **Table** from the right-hand tab to see the results in table form. Again, select each **Trial** in the table several times and compare the probability results.



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Learning objects	LO ID	Years
Exploring probability	6567	6–9

This series contains non-TLF content. See Acknowledgements in the learning object.

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Chance manipulatives (Years 5–12)

These learning objects are manipulatives that allow students to explore and practise a range of concepts and operations relating to probability.



Coin tossing

Explore probability using a coin-tossing simulator.

Instructions

Enter the number of times you want to toss the coin and click on the *Start* button. You can explore the entire run of coin tosses by moving the slider.

With any number of tosses there is a chance error in the number of heads that occurs. If the coin is fair (probability of heads = 0.5), then:

$$\text{number of heads} = \text{half the number of tosses} + \text{chance error}$$

The chance error is likely to get larger as the number of tosses increases.

Observe this growth by replaying the activity with larger and larger values of n (number of tosses). Notice that the chance error grows but that the percentage of heads is likely to be close to 50%. This is the Law of Averages.

Enter a number for the longest run in heads. The default is set to 5. Enter a value for the probability of heads and click on the *Start* button. The coin will be tossed until your desired run in heads is achieved. You can explore the entire run of coin tosses by moving the slider.

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Learning objects	LO ID	Years
Hamlet happens	3532	5–9
Coin tossing	3515	5–12

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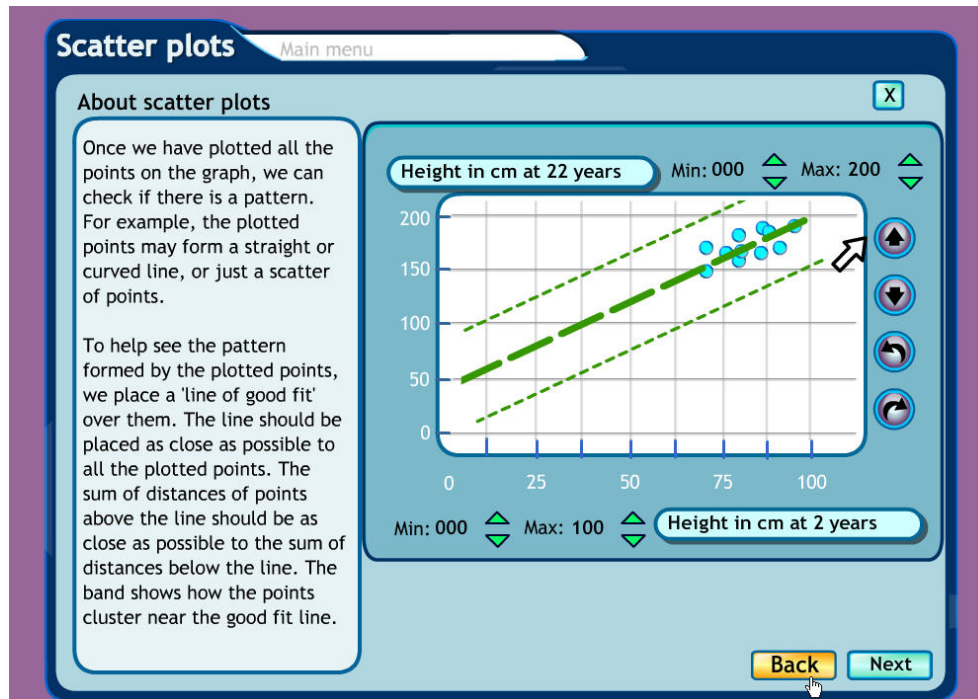
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Chance and data: data focus

The Chance and data: data focus learning objects released to date have are grouped into the following series.

Scatter plots (Years 5–9)

In the Scatter plots series students explore the characteristics of scatter plot graphs and use a line of best fit to identify if there is a positive, negative or no clear relationship between two variables.



Learning objects	LO ID	Years
Scatter plots: about scatter plots	5858	5–9
Scatter plots: height and bellybutton height	5859	5–9
Scatter plots: age and reaction time	5860	5–9
Scatterplots: foot length and hand span	5861	5–9
Scatterplots: create your own data	5862	5–9
Scatterplots	5857	5–9

Comment [JOT1]: Macquarie: one word (but wanted to check what is used in game before changing it)

These learning objects:

- introduce students to the features and uses of scatter plots
- help students to choose axes and scales while constructing scatter plots
- enable students to enter personal data for a statistical investigation
- dynamically display data values on a scatter plot
- relate experimental conclusions to patterns in scatter plots.

Scatter plots: about scatter plots

Students are introduced to the features of scatter plot graphs and learn how to construct and interpret them.

Scatter plots: height and bellybutton height

Students to plot their personal data together with a real data set for the two variables.

Scatter plots: foot length and hand span

Students plot their personal data together with a real data set for the two variables.

Scatter plots: age and reaction time

Students plot their personal data together with a real data set for the two variables. Reaction time is measured through a reaction timer in the learning object.

Scatter plots: create your own data

Students enter data for 20–30 people and create scatter plots for each of the three options: height and bellybutton height, age and reaction time, and foot length and hand span.

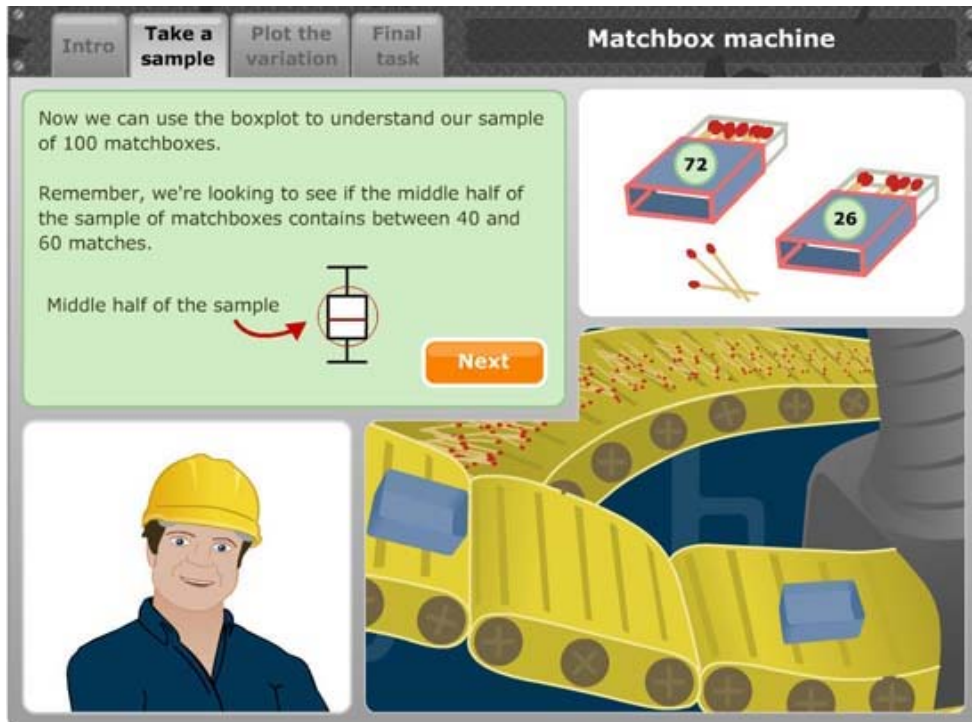
Scatter plots

This is an aggregated learning object combining the five other learning objects in a sequence.

Data samples from the Australian *CensusAtSchools* online education project, 2006, have been provided courtesy of the Australian Bureau of Statistics.

Matchbox machine* (Years 5–9)

The Matchbox machine series is designed to help students understand how to construct and interpret box plots.



Learning objects	LO ID	Years
Matchbox machine: take a sample	2338	5–8
Matchbox machine: plot the variation	2339	5–8
Matchbox machine 🎲🎲	2340	6–9
*Matchbox machine: varying scoop size and speed	2343	5–8
*Matchbox machine: varying scoop size	2336	5–8
*Matchbox machine: varying speed	2337	6–9

*Learning objects in development.

Students are introduced to the quality assurance process through the example of sampling matchboxes. They learn to use boxplots to identify if the process is working correctly.

The data is displayed in a dynamic, sortable table. The students use the sorted table to work out the five-point summary required for a boxplot: maximum, minimum, first and third quartiles and median. They also learn how to use these points to construct a boxplot. The student then interprets the boxplots according to tolerance levels in the quality control manual.

Matchbox machine: take a sample

The student observes a sample of matchboxes being taken, builds a single boxplot and answers a quiz to show understanding.

Matchbox machine: plot the variation

The student observes a sample of matchboxes being taken, builds a single boxplot and answers a quiz to show understanding. A further nine samples are taken and the student builds a series of boxplots for these and answers an additional quiz.

Matchbox machine

This is an aggregated learning unit combining 'Matchbox machine: take a sample' and 'Matchbox machine: plot the variation'.

In the following three learning objects the emphasis is on the variation between samples and on the effect of the scoop size and speed controls on the data collected.

Matchbox machine: varying scoop size and speed

In 'Matchbox machine: varying scoop size and speed', both the scoop size (population mean) and the speed (population standard deviation) vary, and can be adjusted by the student.

Matchbox machine: varying scoop size

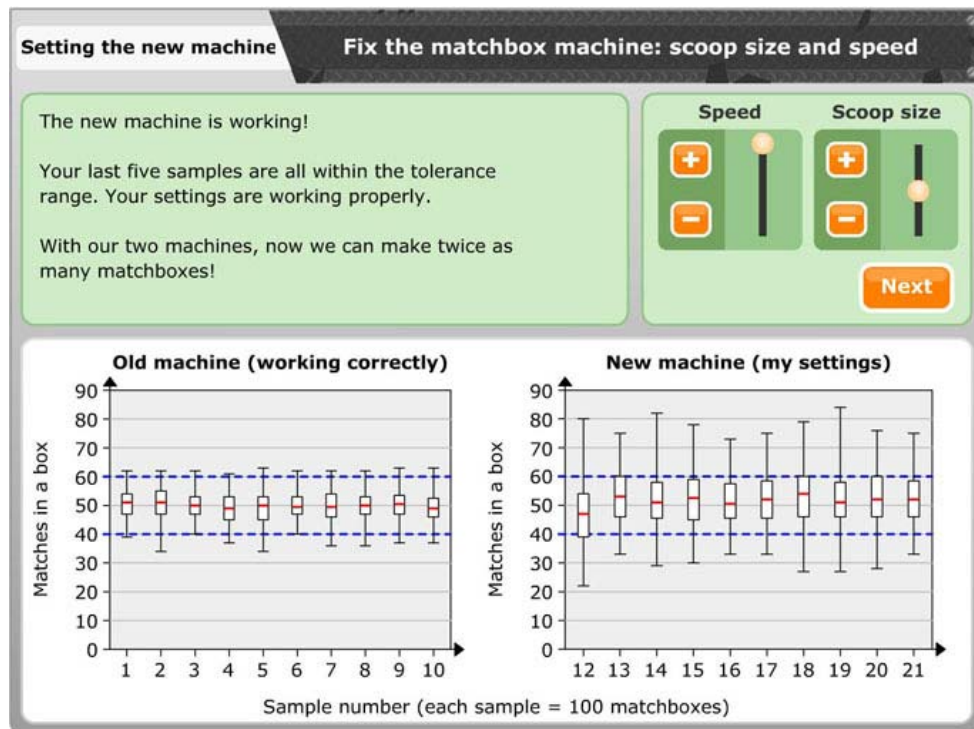
In 'Matchbox machine: varying the scoop size' only the scoop size (population mean) varies, and can be adjusted by the student.

Matchbox machine: varying speed

In 'Matchbox machine: varying speed' only the speed (population standard deviation) varies, and can be adjusted by the student.

Fix the matchbox machine (Years 5–9)

The Fix the matchbox machine series is designed to help students understand how to construct and interpret boxplots. This series complements and extends the Matchbox series.



Learning objects	LO ID	Years
Fix the matchbox machine: scoop size and speed	2343	6–9
Fix the matchbox machine: scoop size	2336	6–9
Fix the matchbox machine: speed	2337	6–9

In each of the learning objects in this series, the matchbox machine is not working correctly. The emphasis is on the student adjusting scoop size and speed controls to relate construction of boxplots to variation between samples. The learning objects illustrate how a tolerance range is tested in quality management. Random generation of values for variables supports repeated use.

Fix the matchbox machine: scoop size and speed

In 'Fix the matchbox machine: scoop size and speed', the machine is not working. Students must adjust the scoop size (mean) and the speed (standard deviation) to achieve five samples within the tolerance range.

Fix the matchbox machine: scoop size

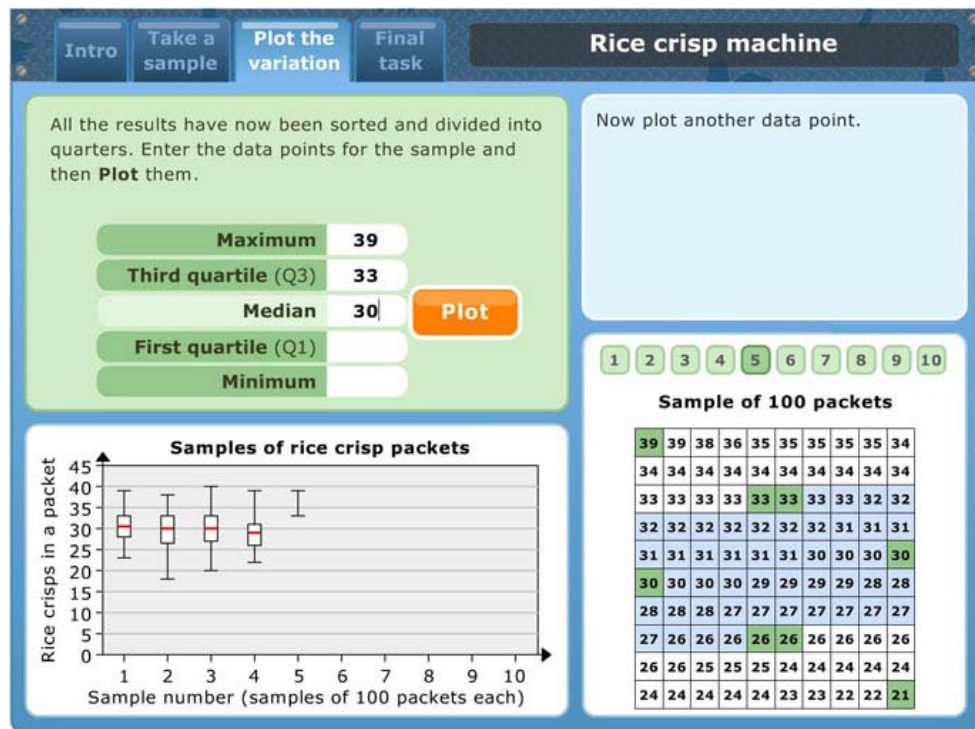
In 'Fix the matchbox machine: scoop size' the machine is not working. Students must adjust the scoop size (population mean) to achieve five samples within the tolerance range.

Fix the matchbox machine: speed

In 'Fix the matchbox machine: speed' the machine is not working. Students must adjust the speed (standard deviation) to achieve five samples within the tolerance range.

Rice crisp machine (Years 5–9)

The Rice crisp machine series is designed to help students understand how to construct and interpret boxplots. This series has the same format as Matchbox machine, however uses a different context and a smaller range of numbers to create a different experience for the student.



Learning objects	LO ID	Years
Rice crisp machine: take a sample	2342	5–8
Rice crisp machine: plot the variation	3192	5–8
Rice crisp machine: 🎲🎲🎲	2341	6–9

Students are introduced to the quality assurance process through the example of sampling rice crisp packets. They learn to use boxplots to identify if the process is working correctly.

The data is displayed in a dynamic, sortable table. The students use the sorted table to work out the five-point summary required for a boxplot: maximum, minimum, first and third quartiles and median. They also learn how to use these points to construct a boxplot. The student then interprets the boxplots according to tolerance levels in the quality control manual.

Rice crisp machine: take a sample

The student observes a sample of rice crisps being packed into a bag, builds a single boxplot and answers a quiz to show understanding.

Rice crisp machine: plot the variation

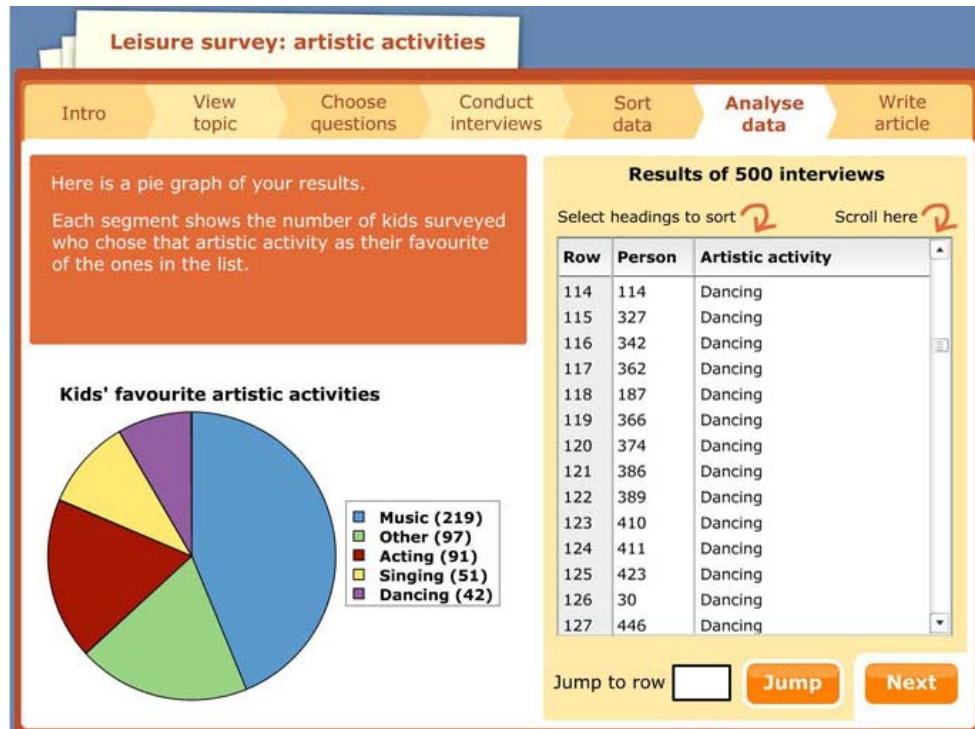
The student observes a sample of rice crisps being packed into a bag, builds a single boxplot and answers a quiz to show understanding. A further nine samples are taken and the student builds a series of boxplots for these and answers another quiz.

Rice crisp machine

This is an aggregated learning object combining the two other learning units.

Leisure survey (Years 6–9)

The Leisure survey series is designed to involve students in the complete survey process, from selecting a topic through to the writing of a newspaper report on their findings.



Learning objects	LO ID	Years
Leisure survey: team sport	3155	6–9
Leisure survey: popular sports	3156	6–9
Leisure survey: artistic activities	3157	6–9
Leisure survey	3154	6–9

In the leisure survey series of learning objects, the student selects a topic about kids' leisure activities to investigate and chooses questions that will elicit appropriate data. Responses for 500 interviews are then generated and displayed in a dynamic, sortable table. Students need to manipulate the table to determine the correct answers to some interpretive questions.

Students then select an appropriate display format from three options to represent the data:

- histogram (continuous data)
- bar chart (discrete data where more than one category can be chosen)
- pie chart (discrete data where there are a small number of categories and where only one category can be selected).

The relevant graph is then drawn for the student and some interpretive questions based on the graph are asked.

In the final part of the learning objects, students choose an appropriate headline for a newspaper article based on the survey results, determine evidence that can legitimately be included and then write the article in a worksheet that can be printed.

Leisure survey: team sport

'Leisure survey: team sport' deals with continuous data and graphs this in histogram format.

Leisure survey: popular sports

'Leisure survey: popular sports' deals with category data, not mutually exclusive responses, and graphs this in bar graph form.

Leisure survey: artistic activities

'Leisure survey: artistic activities' deals with category data on a single dimension where responses are mutually exclusive, and graphs this in pie graph form.

Leisure survey

This is an aggregated learning unit combining the three other learning objects.

Healthy life survey (Years 6–9)

The Healthy life survey series is designed to involve students in the complete survey process, from selecting a topic through to the writing of a newspaper report on their findings.



Learning objects	LO ID	Years
Healthy life survey: bringing lunch to school	3159	6–9
Healthy life survey: staying active	3160	6–9
Healthy life survey: lunchtime activities	3161	6–9
Healthy life survey 🧩	3158	6–9

In these learning objects the student selects a topic about healthy lifestyles to investigate and chooses questions that will elicit appropriate data. Responses for 500 interviews are then generated and displayed in a dynamic, sortable table. Students need to manipulate the table to determine the correct answers to some interpretive questions.

Students then select an appropriate display format to represent the data from three options:

- histogram (continuous data)
- bar chart (discrete data where more than one category can be chosen)
- pie chart (discrete data where there are a small number of categories and where only one category can be selected).

The relevant graph is then drawn for the students and some interpretive questions based on the graph are asked.

In the final part of the learning objects students choose an appropriate headline for a newspaper article based on the survey results, determine evidence that can legitimately be included and write an article in a worksheet that can be printed.

Healthy life survey: bringing lunch to school

'Healthy life survey: who' deals with continuous data and graphs this in histogram format.

Healthy life survey: staying active

'Healthy life survey: what' deals with category data, not mutually exclusive responses, and graphs this in bar graph form.

Healthy life survey: lunchtime activities

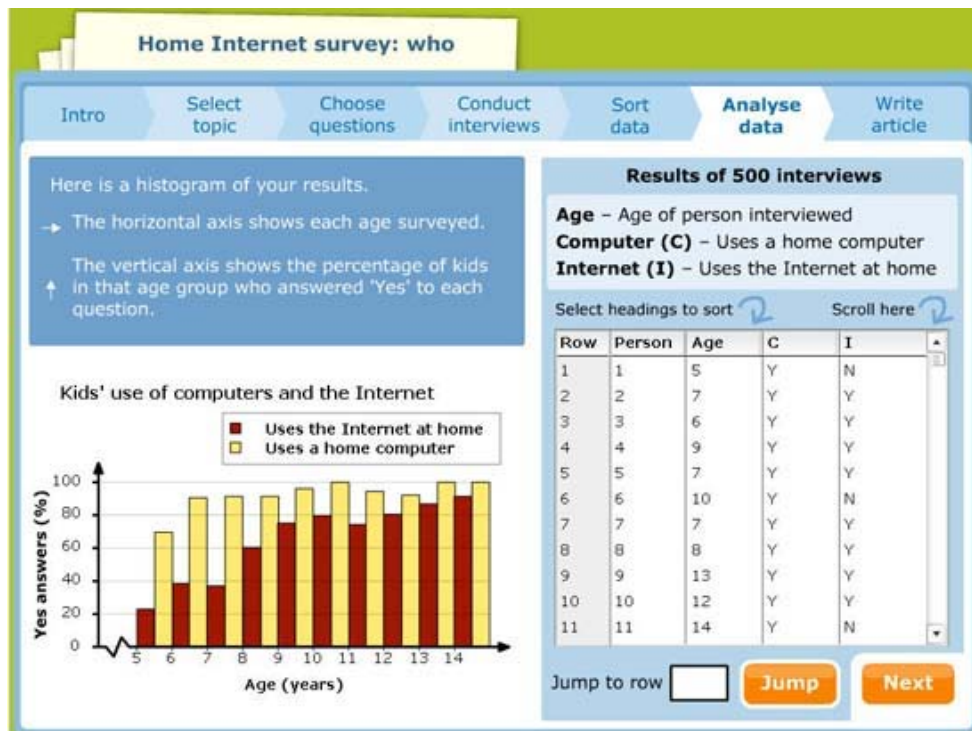
'Healthy life survey: where' deals with category data on a single dimension where responses are mutually exclusive and graphs this in pie graph form.


Healthy life survey

This is an aggregated learning unit combining the other three learning objects.

Home internet survey (Years 6–9)

The Home internet survey series is designed to involve students in the complete survey process, from selecting a topic through to the writing of a newspaper report on their findings.



Learning objects	LO ID	Years
Home internet survey: who?	3151	6–9
Home internet survey: what?	3152	6–9
Home internet survey: where?	3153	6–9
Home internet survey 	3150	6–9

In the Home internet survey series of learning objects, the student selects a topic about internet use to investigate and chooses questions that will elicit appropriate data. Responses for 500 interviews are then generated and displayed in a dynamic, sortable table. Students need to manipulate the table to determine the correct answers to some interpretive questions.

Students then select an appropriate display format to represent the data from three options:

- histogram (continuous data)
- bar chart (discrete data where more than one category can be chosen)
- pie chart (discrete data where there are a small number of categories and where only one category can be selected).

The relevant graph is then drawn for the students and some interpretive questions based on the graph are asked.

In the final part of the learning objects, students choose an appropriate headline for a newspaper article based on the survey results, determine evidence that can legitimately be included and use a printable worksheet to write in the article.

Home internet survey: who?

'Home internet survey: who?' deals with continuous data, and graphs this in histogram format.

Home internet survey: what?

'Home internet survey: what?' deals with category data, not mutually exclusive responses, and graphs this in bar graph form.

Home internet survey: where?

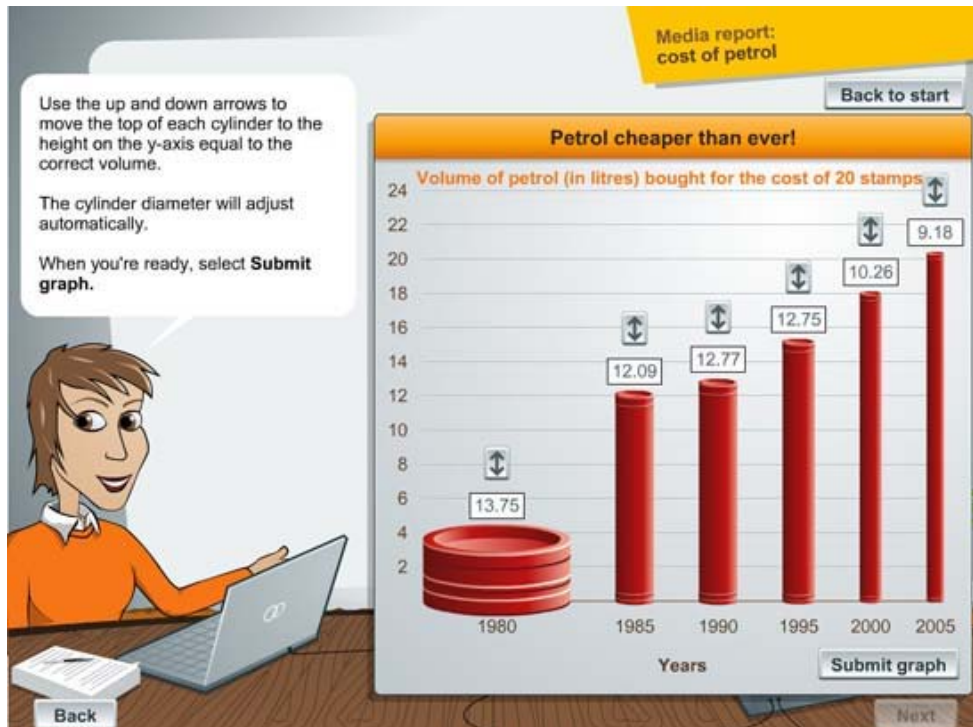
'Home internet survey: where?' deals with category data on a single dimension where responses are mutually exclusive and graphs this in pie graph form.

Home internet survey

This is an aggregated learning unit combining the other three learning objects.

Media report (Years 6–9)

The Media report series encourages students to critically analyse and evaluate the ways in which data has been handled and represented in media reports.



Learning objects	LO ID	Years
Media report: junk food	2625	6–9
Media report: music	2626	6–9
Media report: cost of petrol	2627	6–9
Media report 1 🧩	2393	6–9
Media report: future plans	2629	6–9
Media report: starting salaries	2630	6–9
Media report: water usage	2631	6–9
Media report 2 🧩	2628	6–9

In this series, students apply their knowledge about sound graphing practices involving statistical data using a range of relevant and authentic data sets. They are challenged to develop and apply critical statistical numeracy skills.

In each of the learning objects in this series students assist a magazine editor by analysing the conclusions presented in a magazine before the article is published. Students check that the graph to be included has the features that good graphs should have. They look for any problems that may affect the accuracy of conclusions drawn from the graph and adjust the graph if necessary. They then evaluate whether the claims and conclusions drawn from the graph by the reporter are consistent with the data.

Media report: junk food

In 'Media report: junk food', there are problems with the way that the data has been grouped on the graph in an article about junk food.

Media report: music

In 'Media report: music', there are problems with the way the vertical axis of the graph has been labelled in a magazine article about how people access music.

Media report: cost of petrol

In 'Media report: cost of petrol', there are some problems with the way the data has been represented in the graph in a magazine article about the real cost of petrol.

Media report 1

This is an aggregated learning unit combining Media report: junk food, music and cost of petrol.

Media report: future plans

In 'Media report: future plan', there are some problems with the way the data has been grouped in a magazine article about the future plans of year 12 students.

Media report: starting salaries

In 'Media report: starting salaries', there are some problems with the way the vertical axis of the graph has been labelled in a magazine article about the starting salaries for different occupations.

Media report: water usage

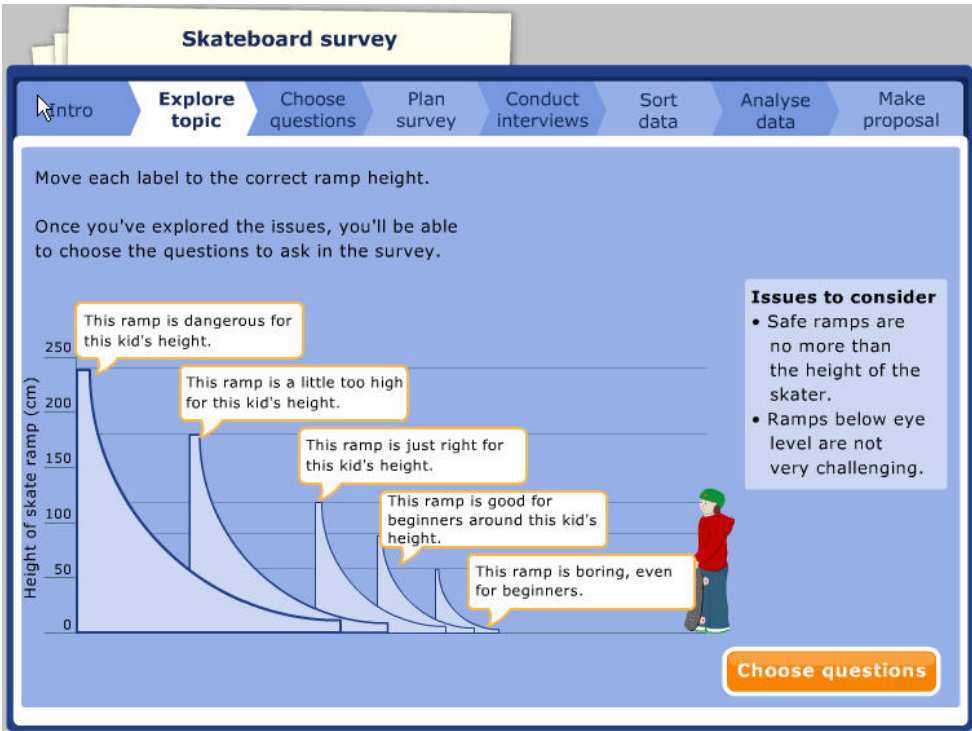
In 'Media report: water usage', there are some problems with the way the data has been represented in the graph in a magazine article about water usage.

Media report 2

This is an aggregated learning unit combining Media report: future plans, starting salaries and water usage in a sequence.

Skateboard survey (Years 6–9)

The Skateboard survey learning object involves students in the complete survey process. Students investigate the safety heights of skateboard ramps and make a proposal to the local council on their findings.



Learning objects	LO ID	Years
Skateboard survey	2394	6–9

Students select appropriate questions for the survey and determine the size of the sample taking account of the cost and margin of error. Responses for the interviews are then generated and displayed in a dynamic, sortable table. Students need to manipulate the table to determine the correct answers to some interpretive questions.

The results from the survey are displayed in a boxplot with an accompanying explanation. Students then answer interpretive questions about the survey results based on the boxplot.

In the final part of the learning object, students prepare a proposal to council based on the survey results and interpretation of the data using a printable worksheet.

Graph investigator* (Years 7–9)

In the Graph investigator series, students select the appropriate data and graph types, such as stem-and-leaf plots, histograms, box-and-whisker plots, scatter plots, pie graphs, line graph and column graphs. Students examine a data set as presented on the chosen graph type and draw a conclusion, relevant to particular investigations.

Graph investigator: concentration
Types of graphs
Main Menu

Do students with better concentration have faster reaction times?

Now use the graph to explore the original question.

Students with better concentration have faster reaction times:

☐ true

☐ false

☐ no clear answer

Data table:

Reaction time in seconds	Concentration score
0.43	36
0.32	40
0.28	29
0.40	48
0.40	36
0.28	32
0.70	46
0.56	53
0.42	48

Graph: Scatter plot

Learning objects	LO ID	Years
*Graph investigator: types of graphs	5904	7–9
*Graph investigator: reaction time	5905	7–9
*Graph investigator: hand preference	5906	7–9
*Graph investigator: getting to school	5907	7–9
*Graph investigator: concentration	5908	7–9
*Graph investigator: homework hours	5909	7–9
*Graph investigator: home Internet access	5910	7–9
Graph investigator	5903	7–9

* Learning objects in development.

These learning objects:

- require students to choose appropriate data relevant to an investigation
- enable students to compare the usefulness of different graph types before selecting the appropriate type to use in an investigation
- provide experiences of how data and graph-type selection depends on the question being investigated
- require students to draw a conclusion from the selected data representation
- provide feedback on inappropriate selections of data or graph type

Graph investigator: types of graphs

Students learn about the different graph types and compare their features and their uses. They learn by experience how data and graph-type selection depends on the question being investigated.

Graph investigator: reaction time

Students select appropriate data sets and choose a useful graph type to investigate whether girls have faster reaction times than boys.

Graph investigator: hand preference

Students select appropriate data sets and choose a useful graph type to investigate whether left-handed and right-handed students have different reaction times.

Graph investigator: getting to school

Students select appropriate data sets and choose a useful graph type to investigate students' most common travel time for getting to school.

Graph investigator: concentration

Students select appropriate data sets and choose a useful graph type to investigate whether students with better concentration have faster reaction times.

Graph investigator: homework hours

Students select appropriate data sets and choose a useful graph type to investigate whether the average number of hours spent on homework increase with year level.

Graph investigator: home Internet access

Students select appropriate data sets and choose a useful graph type to investigate what percentage of students has Internet access at home.

Graph investigator

This is an aggregated learning object combining the five other learning objects in a sequence.

Data samples from the Australian *CensusAtSchools* online education project, 2006, have been provided courtesy of the Australian Bureau of Statistics. The examples in the introduction (type of graphs) contain fictional data.

Content from other sources

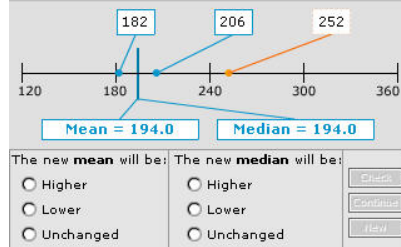
Exploring data (Years 6–9)

These learning objects are short digital activities that allow students to explore concepts and operations relating to the use and interpretation of data.

Exploring measures of central tendency

Changing means and medians

Predict the change in the **mean** and **median** when 1 new response time (in seconds) is introduced:



[Start the activity](#)

Acknowledgements

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Creator LearnAlberta.ca
Identifiers TLF LearningObject L6564
Source Learn Alberta, <http://www.learnalberta.ca> (opens in new window)

Description

Explore and predict the change in the mean and median as new emergency response times are introduced.

Instructions

This activity involves predicting the changes in the mean and median when 1 or 2 new response times are plotted on a data set.

First, study the data set closely and decide whether the mean and median will be lower, higher or unchanged by the new response time. The new response time displays in a flashing box on the data set. Then, select your answers from the radio buttons at the bottom of the screen. Select **Check** to see if you are right. Select **Continue** to predict other response times on the same data set.

Once you have completed all the answers to the changes in the mean and median for one data set, you can select **New** to predict response times on a new data set.



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Learning objects	LO ID	Years
Exploring graphs	6563	6–9
Exploring measures of central tendency	6564	6–9

This series contains non-TLF content. See Acknowledgements in the learning object.

The objects are presented in template format with a description and instructions.

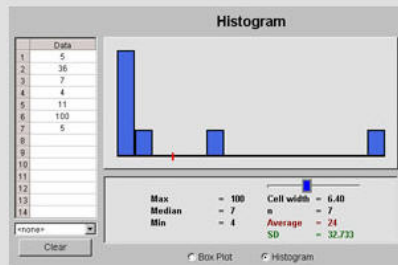
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Data manipulatives (Years 2–12)

These learning objects are manipulatives that allow students to explore and practise a range of concepts and operations relating to the use and interpretation of data.



Box plot / histogram



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Summarise data using a histogram and box plot.

Instructions

A box plot shows the minimum data value, the lower quartile, the median, the upper quartile and the maximum data value on a number line. A box is drawn from the lower quartile to the upper quartile. The median is marked inside the box.

A histogram divides the range of values in a data set into intervals. A block or rectangle whose area represents the percentage of data values is placed over each interval.

The data initially displayed is the time between eruptions for Old Faithful (a cone geyser) in Yellowstone Park in the United States of America.

Clear the data

Click on the *Clear* button. All data values will be removed.

Enter a single data value

Click in the blank data box at the bottom of the data list. You may have to scroll down to show the blank data box.

Learning objects	LO ID	Years
Pie chart	3541	2–9
Spinners	3546	3–9
Bar chart	3512	6–9
Box plot/Histogram	3513	6–9
Scatterplot	3544	9–12

This series contains non-TLF content. See Acknowledgements in the learning objects.

These learning objects are each presented in template format with a description and instructions.

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